Real-Time Hajj Mobile Guidance

by

Ainul Husna binti Abdul Muin

Dissertation submitted in partial fulfillment of
the requirements for the
Bachelor of Technology (Hons)
(Business Information System)

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Universiti Teknologi PETRONAS
Bandar Seri Iskandar
31750 Tronoh
Perak Darul Ridzuan

CERTIFICATION OF APPROVAL

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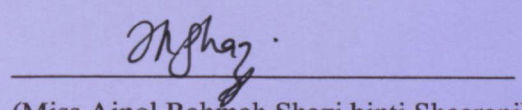
Approved by,



(Miss Ainol Rahmah Shazi binti Shaarani)

UNIVERSITI TEKNOLOGI PETRONAS
TRONOH, PERAK
January 2012

CERTIFICATION OF ORIGINALITY

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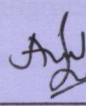

AINUL HUSNA BINTI ABDUL MUIN

ABSTRACT

Information Communication and Technology (ICT) can help to connect people with information faster. The author decided to share the knowledge of Hajj using IT to fully utilize advantages of IT. Real-Time Hajj Mobile Guidance (Hajj-G) is designed to provide real-time guidance to pilgrims in performing Hajj pillars and obligatory acts which is different from the existing Hajj systems in the market nowadays. Hajj-G is a proposed solution to solve the problems faced by some pilgrims during Hajj, where the pilgrims are often confused due to the numerous sequences of the Hajj rituals. This is due to the flexibility of choosing sequences of Hajj pillars to be performed. Based on the feedback from experienced Hajj Experts, getting manual guidance from Hajj experts is not convenient and the Hajj guidance book is not interactive and cannot help to effectively solve problems faced by the pilgrims. The objective of this project is to create a mobile checklist that is very cost-effective and easily accessible by most pilgrims. The application been developed using Rapid Application Development (RAD) methodology. Android has been chosen as the mobile platform to optimize the capability of the Android technology and to leverage on its market potential.

ACKNOWLEDGEMENT

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CHAPTER 1
INTRODUCTION

The author will provide the overview of this project throughout this chapter. This project focuses on one of the Islamic pillars, which is Hajj. Hajj is an obligatory duty for all Muslim who have already reached puberty and can afford to cost of the whole Hajj journey. This Hajj mobile application aims to solve some common problems faced by the pilgrims during Hajj.

1.1 Background of study

Real-Time Hajj Mobile Guidance is a mobile-based application that can guide pilgrims during Hajj. Mobile application is a software application used on mobile phones. Since a few years ago, the mobile applications market is booming due to the increasing percentage of mobile phone users (Wang, 2010).

There are several platforms for mobile applications and the chosen mobile development platform for Hajj-G is Android. Android is an open source software and it allows developers to change the codes according to their preferences (Proffit, 2011). Moreover, it provides a lot of usage and functionality to its users. Android is one of the mobile software that has many development environments (Android Developers, n.d). Furthermore, Android is the most compatible mobile development platform, and the reasons why the author decided to develop this project using the platform will be discussed in Chapter 2.

This Real-Time Hajj Mobile Guidance is an application that can be used as guidance for pilgrims, "Last-Minute" pilgrims and Muslims who are interested to know about manasik (rituals) of Hajj. There are many rules that the pilgrims need to remember during the whole journey of Hajj. Besides that, there are also six pillars and six obligatory acts to be performed.

During the duration of Hajj, all the pilgrim have some flexibility in choosing the sequences of Hajj rituals they want to perform according to their personal

preference. Pilgrims usually will refer to the Hajj expert every time they want to make any decisions regarding the sequences of Hajj pillars they want to perform. Unfortunately, Hajj experts are not always available whenever the pilgrims need them. The pilgrims faced this critical problem every time they want to make any decision and the problem needs immediate advice.

This is one of the reasons why the author chose to develop this project. Thus, the implementation of Real-Time Hajj Mobile Guidance will benefit all parties involved since it can assist pilgrims in choosing the sequences of performing the Hajj rituals and it can help pilgrims to make immediate decision without waiting for advice from the Hajj expert. It also helps the pilgrims keep track of their Hajj activities even in the absence of a Hajj guide.

1.2 Problem Statement

The author had conducted interviews to get the information regarding problems faced by pilgrims during Hajj. According to Lembaga Tabung Haji (Pilgrims Fund Board of Malaysia), every year the Saudi Hajj authority allocates Hajj places for approximately one percent of the Malaysian population. This amounted to about 26 thousand Malaysian pilgrims in 2011. However, until today, most of the pilgrims face the same problems during the performing Hajj. The following are the problems addressed by the interviewees and these problems had been confirmed by one of the Hajj Experts (Abu Seman, 2011):

1. **Hajj guidance book is not interactive.**
   Pilgrims claim that Hajj guidance book is not interactive because guidance book only contains paper with Hajj information printed on it (Abu Seman, 2011). All pilgrim need to digest all the information on their own. So, this application can help them to solve this problem since the application is more interactive than the guidance book.

2. **Manual guidance from the Hajj experts is not convenient.**

   Usually, pilgrims will ask for manual guidance from the experts whenever they have any doubt regarding the sequences of Hajj. However, Hajj experts are not always together with the pilgrims. They can only assist the pilgrims if they are at the same location with the pilgrims when the pilgrims need their guidance. Thus, this application can help replace Hajj experts and can help pilgrims in making immediate decisions.

3. **Complexity and flexibility of Hajj.**

   The pilgrims easily get confuse with sequences of the pillars and obligatory acts of Hajj. The complexity of performing Hajj is due to the many rules that pilgrims need to remember during Hajj to ensure they have successfully completed all the pillars and obligatory acts. Besides that, there is some flexibility in choosing the sequences of Hajj activities (Ahmad Mokhtar, 2011). The pilgrims can choose the Hajj rituals sequences based on their interest. Even though pilgrims had been given sufficient Hajj courses before performing their Hajj, Lembaga Tabung Haji still provide the pilgrims with Hajj guidance book and assign Hajj experts to assist pilgrims during pilgrimage. This clearly shows that Hajj is complex.

4. **"Last-minute" pilgrims may not be able to remember all the rules and required activities.**

   "Last-minute" pilgrims are pilgrims whom be called for Hajj in less than one month before the departure date for Hajj. Most of them are not be able to remember all the rules and required activities within one month. It is because, besides than preparing themselves with Hajj knowledge, they also need to do other Hajj preparation such as clothes, and personal things.

   Pilgrims always aim to get a valid and perfect Hajj. This causes the pilgrims to be very careful before doing any of the pillars and obligatory acts. However, most of pilgrims become confused with the sequences of the rituals due to the complexity and flexibility of Hajj.

1.2.1 Problem Identification

The following are the list of problems that the pilgrims and the Hajj experts are currently facing:

1. Pilgrims

The pilgrims usually become confused with the sequences of rituals that they need to perform during Hajj. This is because all pilgrims had been given flexibility to choose the sequences of Hajj activities to perform according to individual interest. Besides that, the Hajj guidance book is not interactive. This situation forced the pilgrims to interpret the information written in the Hajj guide book based on their own understanding. Different people interpret certain matters differently. Thus, there confusion arises when people discuss the issues and bring their own understanding towards the problem. They will also refer to the Hajj experts but Hajj experts are not always available to assist them.

2. Hajj Experts

Hajj experts are the people who usually have deep knowledge about Hajj matters. They give manual guidance to the pilgrims during Hajj. However, each Hajj expert has a huge group of pilgrims to assist. As a result, they do not have much time to assist every pilgrim regarding the sequences of Hajj activities to perform since each pilgrim will have different choices of Hajj activities sequences.

1.2.2 Significance of the Project

The important of developing this application is to overcome the problems faced by pilgrims and give benefit to all parties involved. This Real-Time Hajj Mobile Guidance can guide the pilgrims to make immediate decisions regarding the sequences of Hajj activities that they need to perform according to their personal choices. The

application also helps ensure the pilgrims perform all the pillars and obligatory acts.

There will be also an added-value on this application, in which the application can educate pilgrims interactively on what are the duties that the pilgrims need to do during each Hajj activity. The pilgrims can also view the checklist of Hajj activities that had been successfully done by them. From this checklist, the pilgrims can know their Hajj progress.

1.3 Objectives & Scopes of study

The objectives of this Real-Time Hajj Mobile Guidance project are:

1. To study the Hajj problem and develop the design for the project.
2. To conduct research on the best platform for development.
3. To develop the application that embedded with several necessary functionalities.
4. To conduct the usability test on the developed prototype.

The scope of study is focusing on the development of mobile application that can provide real-time guidance to pilgrims during Hajj. The study area involved in the project is study the different types of Hajj and the rules of Hajj. This project focuses only on Hajj Tammatu' which required the author to really understand and analyze this Hajj category. It also includes the understanding of duties that need to be performed in order to get a valid Hajj as well as the related *dumm* (compensations).

Since the project is technology-based, the author needed to research various technologies and the capabilities that each technology offers. The author also needed to research the most suitable mobile platform to develop this project.

The study includes the identification of the flow of activities which represent the activities sequences in the mobile application. An entity relationship diagram will be created for the conceptual design of the real-time guidance application.

1.3.1 Relevancy of the Project

The implementation of this Real-Time Hajj Mobile Guidance is relevant to pilgrims because it can assist all pilgrims during Hajj. All pilgrims can make immediate choices of the sequences in performing the rituals according to their personal preferences. For the time being, the author just implement for one type of Hajj first which is Hajj Tammatu' for this Final Year Project development before it can be applicable for the other two types of Hajj which are Hajj Ifrad and Hajj Qiran.

1.3.2 Feasibility of the Project within the Scope and Time Frame

The application will be completed based on the given time frame. The author has two (2) semesters, which is enough to complete this project. During the first semester, the author will concentrate more on research and writing the Final Year Project report. On the other hand, during the second semesters, the author will focus more on implementing the real working application.

CHAPTER 2
LITERATURE REVIEW

The author will discuss in details about the research done that support the development of Real-Time Hajj Mobile Guidance in this chapter. It includes the review and analysis of the work related to the specific topics in this research area.

2.1 Information and Communication Technology (ICT)

The processing, storage and broadcast of information using computer and telecommunications is known as information and communication technology (ICT). ICT is an area that managing technology from wide range of areas including computer software, computer hardware, information systems, programming languages.

In term of education, it means the implementation of information and communication technologies equipment and tools in teaching and learning process. ICT also enabled learning through multiple intelligence mediums such as simulation games, mobile guidance and others.

It gives many impacts to various aspects. It helps to facilitate a more accessible world, increase in freedom of expression, increase access to information and reduce remoteness (Sheahan, n.d). In the other words, ICT enables the user to reach the information easily using wide range of platform. With ICT, everything is on the user fingertips.

2.2 Advantages of ICT

One of the advantages of IT is computerized which it can convert all information into a computer-based for increased productivity and make the information global accessible. Besides that, IT also connects people faster with the information required (Buzzle.com, 2011).

Besides that, ICT can process repetitive processing better than human. Human usually get tired and lose concentration when they have to repeat the same task again and again. However, machines able to perform the same task repeatedly with consistent quality.

Data communications are fast and accurate which it can reach the data needed from any places in the world within few seconds only. For example, we can search a document from Oxford University student journal within few seconds using Internet website. Moreover, data can be output into the devices in a variety formats. For example, if a user what to make a checklist about Hajj, the user can displays the checklist in a list of checkbox with the information about Hajj on it.

It also provides cost-effectiveness because it provides more information for less money spends for the information. In order to fully utilize the advantages of ICT, the author decide to spread the knowledge of Hajj using ICT.

2.3 Hajj

As a Muslim, there are five basic acts that need to be performed and all these five basic acts are called Five Pillars of Islam. These five pillars are considered as obligatory by Sunni Muslims. The five pillars are recite the shahada, perform the Islamic daily prayers which is five times a day, fasting during Ramadan, paying Zakat and perform Hajj which is pilgrimage to Mecca during months of Hajj (Muhammad Dindang, 2003).

Hajj is a duty that all Muslim who had reached the age of puberty need to perform (Ahmad, 2006). All Muslim can perform Hajj during the months of Hajj, which is from 1 Syawal until sunrise on 10 Dhul Hijjah. It is essential for all Muslim to perform all the five pillars of Islam, which include Hajj.

Hajj is a duty of necessary which means that it is compulsory for Muslim whom have enough money needed for their journey to Mecca and back home, for their stay during the journey including money for daily necessities of their family members during their absence.

There are three type of Hajj (Bayat, 2006). The following are the type of Hajj:

1. Hajj Ifrad

This is the simplest Hajj. Pilgrims whom perform Hajj Ifrad will perform Hajj alone during the months of Hajj.

2. Hajj Qiran

This hajj means combine two things. Pilgrims will simultaneously perform Hajj and Umrah during the months of Hajj.

3. Hajj Tammattu'

This hajj means to take advantage of facility. Pilgrims who perform this kind of Hajj will perform Umrah first and only after that they will performHajj during the months of Hajj.

Pilgrims need to perform all the pillars and obligatory acts to get a valid and perfect Hajj. Pilgrims have the flexibility to choose the sequences of pillar acts to perform (Ahmad Mokhtar, 2011). If he missed any of the pillars, their Hajj is not properly accomplished. The pillars of Hajj are*Ihraam*which male have to wear the two pieces of clothes, *Niyyah*(intention) to perform Hajj, *Wuqoof* at *Arafat, Tawaaf, Saee* which

is traversing between Safa and Marwah for seven times and to shave the head for male or cut some hair (Baianonic, 2000).

For the obligatory acts, pilgrims need to do all the acts.If they failed to accomplish one of the obligatory acts, they need to pay *dumm*(compensation). All the obligatory acts of Hajj are *Niyyah*(intention) at *Miqat*, *Wuqoof* at Muzdalifah, *Mabit* at Mina, pelting at *Jamrah Kubra*, avoid doing all the thirteen prohibitions, and pelting at the three *Jamrat*.

2.4 Existing System Developed for Hajj

There are lots of existing systems for Hajj that available in the market nowadays. The example platform used by the existing system are mobile application, 3D application, website and PC software. One example of mobile application for Hajj is Hajj & Omrah (Video) Authentic Guidance. This application is designed for mobile iOS. The purpose of the system is to provide a better way to learn on how to perform Hajj and Umrah using video. (ZDNet, 2011).

The Development of 3D Tawaf Simulation for Hajj Training Application Using Virtual Environment is one example of 3D application. This application aims to provide interactive training method for Hajj education in Malaysia by providing the user a scene of one of the Hajj pilgrimage rituals, which is *Tawaaf* (Mohd Rahim, Azizul Fata, Basori, Rosman, Nizar and Mohd Yusof, 2011).

For website developed for Hajj, one of the website is Web-based Hajj Simulation Software. It used to provide interactive ways of learning Hajj through simulation (Fathnan, Wibowo, Hidayat, Marenda and Ferdiana, 2010). An example of PC software for Hajj is Hajj and Umrah 1.0 that display all the information for Hajj together with collection of Quranic verse on Hajj and Umrah (PDATopSoft, n.d). People nowadays rarely used PC software since it is not convenient.

All the existing system developed for Hajj mainly focus on how to guide pilgrims and and provide information about Hajj and Umrah. Unfortunately, these available systems do not help to overcome problems faced by pilgrims that the author had discussed in Chapter 1.

2.5 Mobile Application

Mobile application is synonymous with our daily lives nowadays. Mobile application is software that runs on smart phones or mobile phones. It designed to educate, entertain or assist people in their daily life.

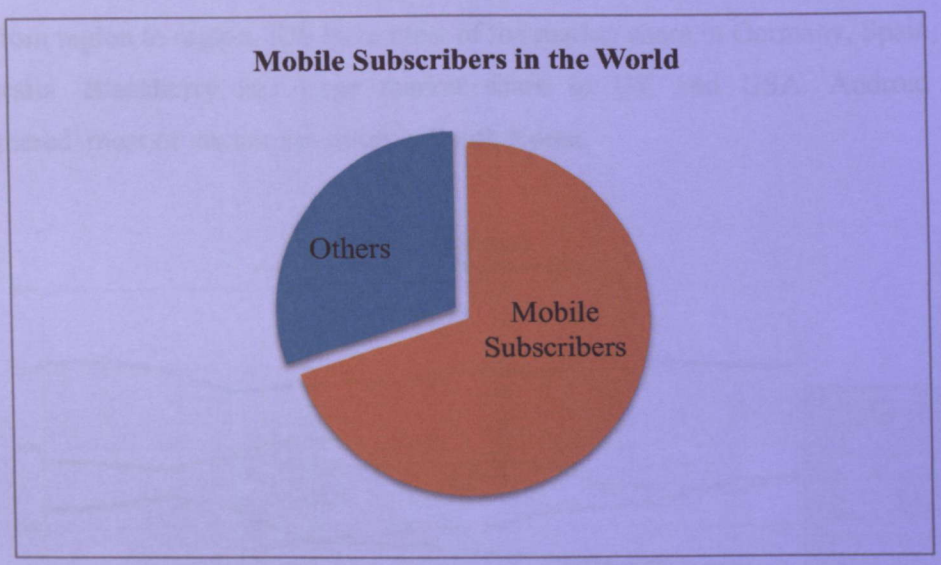


Figure 2.1: Mobile Subscribers in the World (mobiThinking)

According to mobiThinking (2011) about 77 percent of the world population are mobile subscribers. Based on Figure 2.1, the big ratio of mobile subscriber clearly shows the huge number of mobile users. Over 110,000 mobile applications had been developed daily and more than 15 million consumers are using this application (Farago, 2011). This eventually shows the high demand of mobile applications nowadays.

Mobile application can created across a wide area of usage and functionality. One of the add-value of mobile application is it can provide interactivity which is absent in a traditional books. Besides that, mobile phones have large storage space and for

example 2GB storage space store up to 20 mobile applications. Thus, it can store more information compare to book.

Hajj guidance using mobile applications is more practical and convenient than using Hajj guidance books. The light and small size of the mobile phones will be the add-value for the pilgrims since they need to travel to many places during the Hajj.

2.6 Mobile Application Share Market

Comparison between different mobile OS market share shows the various market shares from all around the world together with the percentage share for each mobile OS from region to region. iOS have most of the market share in Germany, Spain, and Australia. Blackberry has large market share in UK and USA. Android has conquered most of the market share in South Korea.

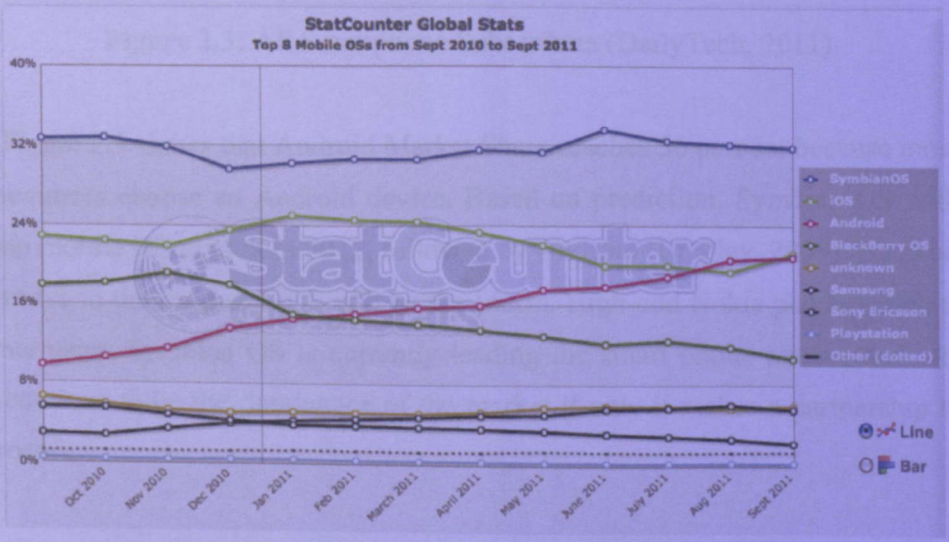


Figure 2.2: Top 8 Mobile OSs from September 2010 to September 2011 (GlobalStats, 2011)

From the data extracted according to Figure 2.2, the top four mobile operating systems in the world from September 2010 to September 2011 are Symbian OS, iOS, Android OS and Blackberry OS.

For the last six months, among new smart phone users, Android is leading the mobile OS market (Nielsen, 2011). According to a new survey from technology-tracking firm comScore Inc. (Valentino-DeVries, 2011), Americans used mobile phones that embedded with Android system powered by Google Inc. rather than Apple Inc. 's iPhone.

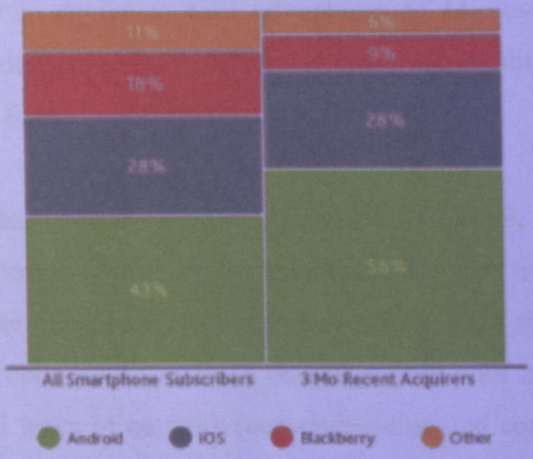


Figure 2.3: All Smartphone Subscribers (DailyTech, 2011)

The Figure 2.3 shows that Android Market Share reaches 56 percent because most of the acquirers choose an Android device. Based on prediction, Symbian OS will be the top mobile OS market in 2012, followed by Android (Bradley, 2009). Blackberry will move to the third and iOS will be the fourth. High-end Nokia phone which uses operate using Symbian OS is currently leading the smart phone market and Nokia will continue to be the dominance of the market if only it makes a partnership with Microsoft.

Based on the market share analysis, it can be concluded that Symbian OS and Android OS will be holding more market share in future and Nokia will be continue to play an important role for some of the emerging countries.

2.7 Android

The four main development environments that will be discussed in further are Android, Java ME, Windows Mobile and Symbian OS. 1) Android is a Linux based operating system introduced by Google for smart phone. 2) Java ME supports large range of mobile devices up to high-end Symbian devices. 3) Windows Mobile enables a high-end mobile device to take advantages of Microsoft .Net compact framework and it is an alternative for professional users. 4) Symbian OS is an open source operating system for high-end Nokia phone.

The following justification related to the comparison of Android, Symbian OS and Window Mobile is summarized from (Spekmann, 2008). The first comparison is about open platform. The criteria of open platform are it allows the system to have more functionality. An open platform must be compatible with all mobile devices and it must have several ways of network (communication and connectivity). Based on the criteria of open platform, all the operating systems achieve the criteria that allow developer to build application on it. However, only Android enables developers to develop a free application.

Platform can be more open and attractive if they have several standards. Some of the important standards that need to be considering for this system are using standard programming language like Java and use data synchronization such as SyncML. All the three mobile operation system using data synchronization but only Android is using Java as the programming language.

Mobile OS	Advantages	Disadvantages
Android	• Open source communities. • Programming language tightly integrated with operating system. • Complete interface for application development. • Good integration between development environment and actual device. • Have interesting way to distribute application, which is using Android market.	• Do not have user interface that displays results.
Java ME	• Open source communities. • Support many types of devices.	• Must extent certain base MIDlet application to get the test run. • On-device debugging is limited on Symbian phones.
Windows Mobile	• Programming language tightly integrated with operating system. • Complete interface for application development. • Good integration between development environment and actual device. • Tight connection with Microsoft.	• Limited to Visual Studio develop by Microsoft.

Table 2.1: Advantages and Disadvantage of Android, Java ME and Windows Mobile (Gronli, Hansen and Ghinea, 2010).

Throughout the analysis made from Table 2.1, Android is the best mobile environment among the other leading mobile environment. Android is an open platform and it has all standard needed for open platform. It has the benefit of tightly integrated with the operating system on the mobile phone. Android also bring a new and interesting way to distribute application, which is through Android market.

Besides that, Android provides a better development environment because it includes device emulator, debugging tools and a plugin for Eclipse IDE. It also has a wide range of media support for still image, audio and video. It also have a bright future in mobile OS market share that been discussed in Section 2.6.

CHAPTER 3
METHODOLOGY

In this chapter, the author will discuss phase-by-phase the development of the Real-Time Hajj Mobile Guidance according to the phases in System Development Life Cycle (SDLC). There are several types of system development methodologies, and each methodology has different unique approach to implement the SDLC.

3.1 System Development Methodology

The author decides to develop this application using Rapid Application Development (RAD) model. This RAD model is a model for software process. This model is being selected because it uses iterative prototyping and suitable for resource constraints project (Mortimer, 1995). Figure 3.1 show the RAD model that been used to implement the SDLC. Besides that, it uses minimal planning and analysis and focus more on prototyping.

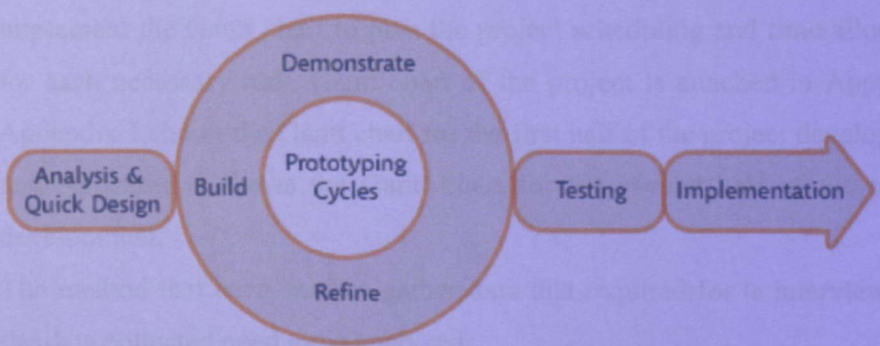


Figure 3.1: Rapid Application Development (RAD) Model (Martin, 1991)

This model is more effective to be implement compare to the other SDLC model because it is designed for tight time-scale project development. The author only has two (2) semesters to accomplish this project and this is one of the reasons why the author chooses to use RAD model. RAD model is more applicable than Waterfall model because the author can continuously work with the prototyping until it meets

the user needs. This is important because the prototyping of the application usually change from time to time according to the users requirements.

However, not all the phases in SDLC are included due to time constraints. Therefore, this chapter will only include six (6) phases of the RAD model, which are planning, analysis, design, prototyping cycle, testing and implementation.

3.2 Planning and Data Gathering Phase

The first phase of the project development is the planning and data gathering phase. This phase is important since it define all information that is required to ensure the development of the project successful. The following are the steps that been carried out by the author during this phase:

- The author redefined the topic for this project. The background study, problem statement, objectives, scope of the application and existing research paper that related to this project are identified and documented.
- Decide the tools that required for the development of the application.
- Implement the Gantt chart to plan the project scheduling and time allocation for each necessary task. Gantt chart of the project is attached in Appendix. Appendix 1 shows the Gantt chart for the first half of the project development and Appendix 2 shows the Gantt chart for the second half of the project development.
- The method that been used to gather data that required for is interviews and the data collected need to be analyzed.

3.3 Analysis Phase

After the planning phase is completed, the author proceeds to the second phase of the project development, which is analysis phase. This phase is important because result of the analyzed data will determine whether the application meets the user requirements or not. During this phase, the author analyzed all the data and requirements collected during planning phase. The following are the steps taken during the analysis phase:

- The author conducted an interview to gather the information regarding problems faced by the pilgrims. The result of the interview will be discussed in chapter 4.
- The author analyzed the best method to overcome problems faced by the pilgrims using research paper.
- The author produce a flowchart that describes the flow of the application based on the result of the interview.
- The author develops an understanding of the users activities and how the users interact with the application.

3.4 Design Phase

During design phase, the author needs to design the graphical user interface, the conceptual, physical designas well as the system architecture of the application. All the designs are important for the development of the system. These designs are based on the result of the data analysis.

3.4.1 Graphical User Interface

Before the author can start with the programming part, the author needs to have a developed and tested paper-based graphical user interface design (Sommerville, 2004). In order to come with a developed and tested designs, the author need produce paper-based design prototype based on the data analyzed. After that, the paper-

based design needs to be evaluated by the users. The author has to collect all the information regarding the users' response towards the interface.

After getting all the feedback from the users about the user interface, the author started to design the real working interface using Adobe Photoshop. The graphical user interface design will be discussed in details in chapter 4.

3.4.2 Conceptual Design

The author has to design the UML diagram, which consists of package diagram and flow chart of the application in order to produce conceptual design. This conceptual design includes the functionality of the application and the sequences of Real Time Hajj Mobile Guidance activities. Package diagram is used to show the data model of the application, which includes the logical relationships between package diagrams. Besides that, flow chart shows the process of the system. The author use OmniGraffle software to constructs these diagrams. The outcome of the results will be discussed in chapter 4.

3.4.3 Physical Design

The project will be developed using a personal computer that has the required software. In order to design the graphical user interface, the author needs Adobe Photoshop software. For development using Android environment, it needs an Android emulator, which an Android SDK has to be installed. Table 3.1 shows the specifications in developing the project:

Tools	Specifications
Software	Eclipse IDE, Android SDK, Adobe Photoshop
Hardware	Personal Computer, Android Phone

Table 3.1: Development Environment Specifications

3.4.4 System Architecture

This Real-Time Hajj Mobile Guidance is a stand-alone application which integreted with a database. This database is used to store all the data input by the user of the system. The author used the SQLite database for this application. This is to ensure all the data will be store parmenantly in the application and the data been stored can be retrieved whenever the user wish to continue using the application. Refer Figure 3.2 for the Real-Time Hajj Mobile Guidance (Hajj-G) system architecture.

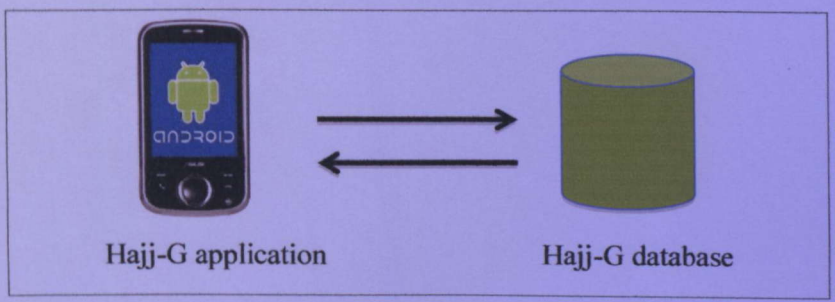


Figure 3.2: Real-Time Hajj Mobile Guidance System Architecture.

3.5 Prototyping Cycle Phase

After the conceptual and graphical user interface design completed, the author proceed to the next phase. The fourth phase for RAD model is prototyping cycles. During this phase, the author continuously refines, build and demonstrate the prototype until it meets the users need and satisfaction. The author need to install all the software required such as Eclipse IDE and Android SDK before the author can start to develop the prototype. The following are the steps carried out for prototyping cycle:

- The author needs to refine the prototype model that meets the users requirement.
- The prototype been build based on the conceptual and the graphical user interface design.
- The author codes the XML design of the graphical user interface for the prototype.
- The author codes the class diagram of the prototype, which consists of the attributes and function for each class.
- After the cycle of the prototype done, the author demonstrate the prototype to the users.

The five steps above will be repeated until the users satisfy with the developed prototype.

3.6 Testing Phase

After the author had developed a prototype that meets the user satisfaction, the author can start with testing of the prototype. The author selects several qualified tester to test the prototype. Among the qualified tester are lecturers, parents, and students. Besides than testing the usability of the system, they also test the flow of the activities.

In order to test the functionalities and the integration of the application, the author had developed an integration test plan. For testing phase, the author conducted a post-implementation survey to evaluate the effectiveness of the prototype. The enhancement of the prototype will be taken into consideration based on the results gathered from testing phase. The result of the post-implementation survey and integration test plan will be discussed in Chapter 4.

3.7 Implementation Phase

The final phase for project development is implementation phase. During this phase, the author can start to implement the complete application before the application can be delivered to the users. The complete application is the enhancement of the prototype based on the feedback gathered during testing phase.

Most of the time allocated for this project development is devoted to implementation phase. A big part of this phase is related to the technical works such as hardcode the real working system. The result during the implementation phase will be discussed in details in Chapter 4.

CHAPTER 4

RESULT AND DISCUSSION

After the system development life cycle had been completed, the author manages to gather all the results of the project development. This chapter will be divided into two parts; part one consist of discussion about the results from the interviews conducted, the proposed solution, the UML diagram, the functionalities of the application, the sequences of the application activities, basic navigation procedure and part two will discuss about the project development, integration test plan and post-implementation survey.

4.1 Interview Result

The author had conducted interviews to several parties whom involved with Hajj. The aim of these interviews is to get explanation from for a better understanding about the current Hajj situation. The following are the parties whom involved with Hajj:

4.1.1 Parties whom involved with Hajj

Hajj Expert: The term "Hajj Expert" refers to the person who guides pilgrims during Hajj. Hajj Expert has high knowledge about Hajj and Hajj Experts usually give manual guidance to the pilgrims during the Hajj journey.

Pilgrims: The term "Pilgrims" refers to the person who performs Hajj. Pilgrims use Hajj Guidance Book as the references. However, most of the time, pilgrims seek for manual guidance from the Hajj Expert if pilgrim has any doubt during the Hajj journey. It is because book is not interactive in give guidance.

In order to develop the Real-Time Hajj Mobile Guidance, the author needs to understand the overall flow of Hajj activities. Several meetings with the parties involved as mention in Section 4.1.1 had been conducted. It is because the parties can be considered as clients whom hire the author to develop the Real-Time Hajj Mobile Guidance. The following are the questions asked to the parties:

4.1.2 What are the problems faced by the pilgrims during Hajj?

The common problem faced by most of the pilgrims is they usually get confused with the sequences of Hajj rituals to perform. This is due to the complexity and flexibility of Hajj. Besides that, the pilgrims need to pay the *dumm* (compensation) if they unable to perform any of the Hajj obligatory and pillar acts or they do any of the prohibitions during State of Ihram. Different *dumm* applies in different situations.

4.1.3 What are the problems faced by the Hajj Expert during Hajj?

The main responsibility of the Hajj Expert is to give manual guidance to the pilgrims during Hajj journey. However, they will not always available whenever the pilgrims need them. Moreover, it is not convenient for the Hajj Expert to entertain each of the pilgrims on the same time. It is because different pilgrims usually request for different manual guidance based on their own personal preferences.

4.1.4 Explain the flow of actions that the pilgrims usually take to overcome the problem faced during Hajj.

There are several actions that can be taken by the pilgrims to overcome the problem faced as discuss in Section 4.1.2. Figure 4.1 show the flow chart of actions that the pilgrims usually take to overcome the problem faced during Hajj.

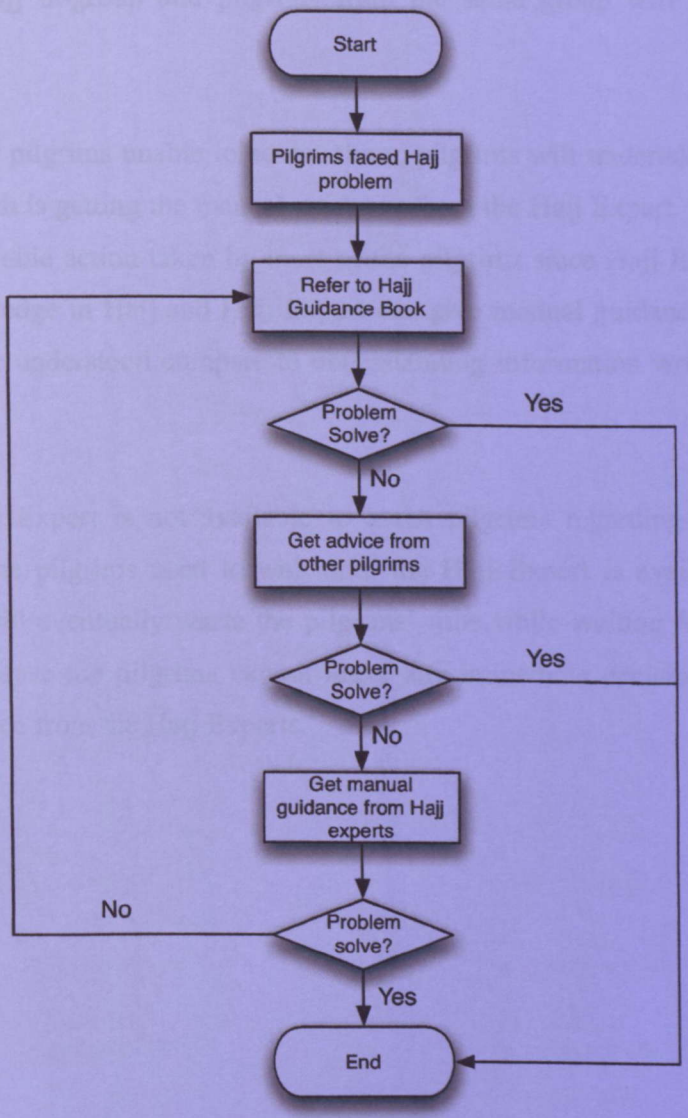


Figure 4.1: Flow Chart of Action Taken by Pilgrims

The first action that the pilgrims will take is referring back to Hajj Guidance Book to solve the problem they currently faced. They need to digest all the information written in the book in order to get a clear understanding about the issue.

If the Hajj Guidance Book does not solve the problem, the second action that the pilgrims will do is seeking advices from the other pilgrims regarding the problem. However, the pilgrims rarely take this action since pilgrims usually perform Hajj in-group and pilgrims from the same group will face same problems.

If the other pilgrims unable to advise them, pilgrims will undertake the next action which is getting the manual guidance from the Hajj Expert. This is the most preferable action taken by most of the pilgrims since Hajj Expert have high knowledge in Hajj and Hajj Expert can give manual guidance which is easier to be understood compare to understanding information written in the book.

If the Hajj Expert is not available to assist pilgrims regarding their Hajj problem, the pilgrims need to wait until the Hajj Expert is available. This situation will eventually waste the pilgrims' time while waiting for the Hajj Expert because the pilgrims cannot make any immediate decisions without any guidance from the Hajj Experts.

4.1.5 Explain the flow of the Hajj Tammatu' pillar acts activities and where do you take part ?

For Hajj Tammatu', the pilgrims need to perform Umrah at first before they can proceed with Hajj. Figure 4.2 shows the flow chart of Hajj activities that need to be performed by all the pilgrims. This flow chart only consists of pillar activities only.

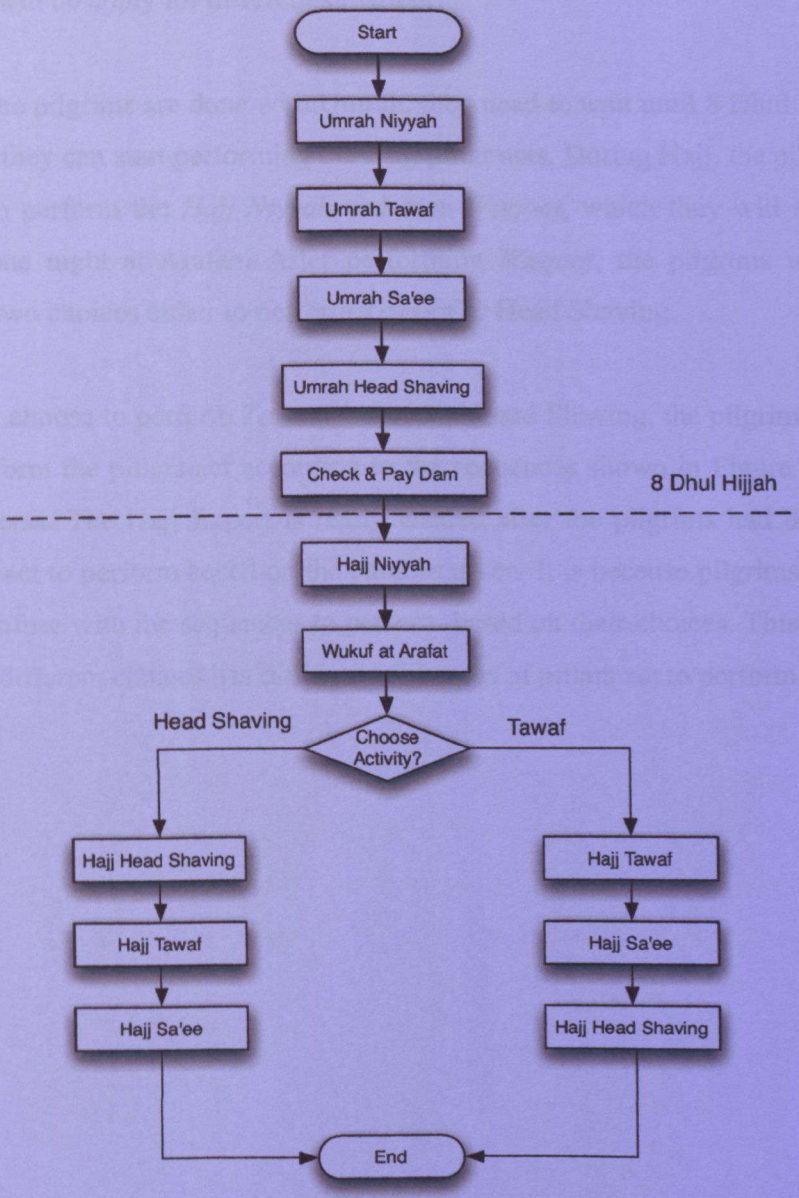


Figure 4.2: Flow Chart of Hajj Tammatu' Activities

During Umrah, the pilgrims need to perform the *Umrah Niyyah*, *Tawaaf, Saee* and Head Shaving. All these acts need to be done in orderly one after another. Before the pilgrims done with the Umrah, they need to pay *dumm* if they do any of the prohibitions during the State of Ihram or unable to perform any of the Umrah obligatory and pillar acts. The Hajj Expert is need when the pilgrims need to pay the *dumm*. It is because the pilgrims need the Hajj Expert to guide them on which type of *dumm* they need to pay since different *dumm* will be apply for different situation.

After the pilgrims are done with Umrah, they need to wait until 8 Dhul Hijjah before they can start performing the Hajj pillar acts. During Hajj, the pilgrims need to perform the *Hajj Niyyah* and then *Wuqoof*, which they will stay at least one night at Arafah. After performing *Wuqoof*, the pilgrims will be given two choices either to perform *Tawaaf* or Head Shaving.

If they choose to perform *Tawaaf* instead of Head Shaving, the pilgrims need to perform the pillars act according to the sequences shown in Figure 6, and vice versa. The Hajj Expert is really needed after the pilgrims had decided which act to perform based on the choices given. It is because pilgrims easily get confuse with the sequences to perform based on their choices. This is due to the different choices has different sequences of pillars act to perform.

4.1.6 If this application will be developed to overcome problems faced by the parties involved in Hajj, what is your opinion and suggestion of the user interface design?

Pilgrims strongly agreed with the implementation of this application. Everyone seem to experience some difficulties with the traditional ways of overcome problems faced during Hajj, based on the problem statements discussed in Chapter 1. Hajj Expert also claims that they need the application in helping them to assist the pilgrims during Hajj.

Both parties did point out some suggestions on how they want the application to be look like. They drew several paper-sketch of the application interfaces and the author evaluates on how to develop it. Every week, the author will schedule an appointment with the both parties to get the feedback on the prototype. If any, the author will refines and rebuild the prototype based on the feedback. This step is called the prototyping cycle. The prototype will keep on changing until it meets the user satisfaction.

4.1.7 Is there any restrictions in using mobile gadgets during the Hajj journey?

According to the Saudi Arabia laws, the usage of mobile gadgets in restricted at Madinah, which is not related to the places to perform Hajj activities. Besides that, it is not encourage for the pilgrims to use mobile gadgets while performing Hajj. This issue would not be a problem for the pilgrims to use this Real-Time Hajj Mobile Guidance because this mobile application purpose aims to assist pilgrims in choosing the sequences of Hajj activities to perform.

1.2 Proposed Solution: Checklist

In order to solve the problem, the author decides to use checklist method. Checklist is a list consists of important actions or steps to be taken in a specific order according to Mindfire Solutions (2003). This is the most suitable method to overcome this problem since the problem that been faced by most of the pilgrim is they easily get confuse with the sequences of the pillars and obligatory acts.

The advantages using checklist over other methods is checklists can work as a reminder because there are possibility pilgrims will forget any of the pillars and obligatory acts. This is due to the flexibility in performing the pillars and obligatory acts. It can also give a clear overview of what pilgrims need to do because the checklist only describe exactly what duties a pilgrim need to do.

Checklist can save time because a pilgrim does not need to spend time remembering the steps all the time. Checklist can also help pilgrims to achieve their aims to get a perfect Hajj. It is because it can ensure pilgrims perform all the pillars and obligatory acts.

4.3 UML Diagram

Refer Figure 4.3 for the UML package diagram of the Real-Time Hajj Mobile Guidance. There are lots of changes and discussions have done by the author before the author can successfully produce a correct diagram with all the application functionalities.

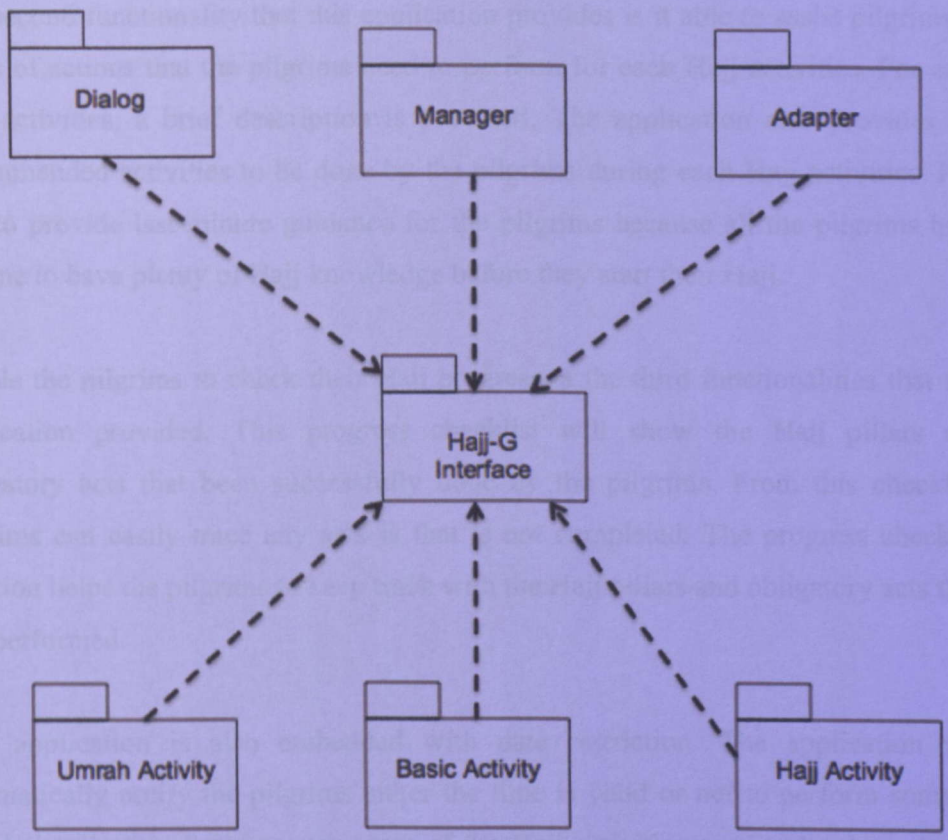


Figure 4.3: Package Diagram of Real-Time Hajj Mobile Guidance

4.4 Functionalities of Real-Time Hajj Mobile Guidance

For the development of the Real-Time Hajj Mobile Guidance, the author decides to develop an application that can provide real-time guidance to pilgrims during the Hajj journey. This application wills immediate give options for the pilgrims to choose the next acts that they need to perform based on destination, if any. Therefore, this function definitely overcomes problems currently faced by most of the pilgrims during Hajj based on the problem statements discussed in Chapter 1.

The second functionality that this application provides is it able to assist pilgrims in terms of actions that the pilgrims need to perform for each Hajj activities. For each Hajj activities, a brief description is provided. The application also provides the recommended activities to be done by the pilgrims during each Hajj activities. It is aim to provide last-minute guidance for the pilgrims because all the pilgrims been assume to have plenty of Hajj knowledge before they start their Hajj.

Enable the pilgrims to check their Hajj progress is the third functionalities that this application provided. This progress checklist will show the Hajj pillars and obligatory acts that been successfully done by the pilgrims. From this checklist, pilgrims can easily trace any acts is that is not completed. The progress checklist function helps the pilgrims to keep track with the Hajj pillars and obligatory acts they had performed.

This application is also embedded with date restriction. The application will automatically notify the pilgrims either the time is valid or not to perform some of the Hajj activities. It is because some of the Hajj activities need to be done during specific time only. The additional feature of this application is it available in two languages, which are English and Malay.

4.5 Sequences of Real-Time Hajj Mobile Guidance Activities

Before starting with the development of the real working application, the author must gather and analyses the sequences of the Hajj activities. The flow of activities started with Umrah activities followed by Hajj activities starting on 8 Dhul Hijjah. Refer Figure 4.4 for the flow chart of this application. This flow chart includes the activities path for each chosen destination as well as chosen Nafar.

From this flow chart, the author also develops a timeline of Hajj activities. This is because there is a specific period of time to perform some of the activities. This timeline only consists of Hajj activities since Umrah activities can be perform at anytime before 8 Dhul Hijjah. Refer Figure 4.5 for the timeline of Hajj activities. Since this application needs to be synchronized with time and date of the device, the author used this timeline as the guideline to implement the time and date in the application.

By having this flow chart and the timeline of Hajj activities, the project development work smoothly.

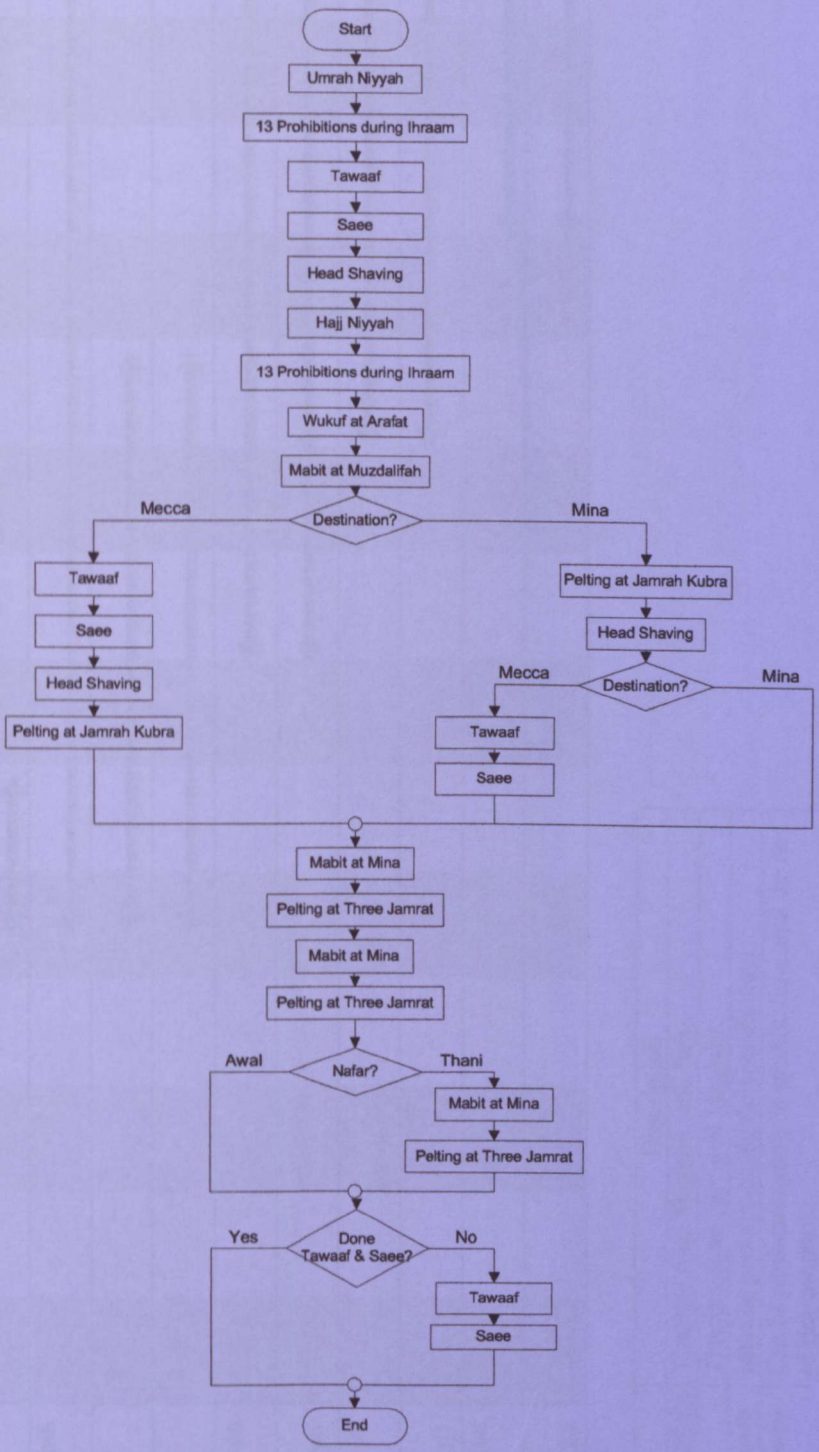
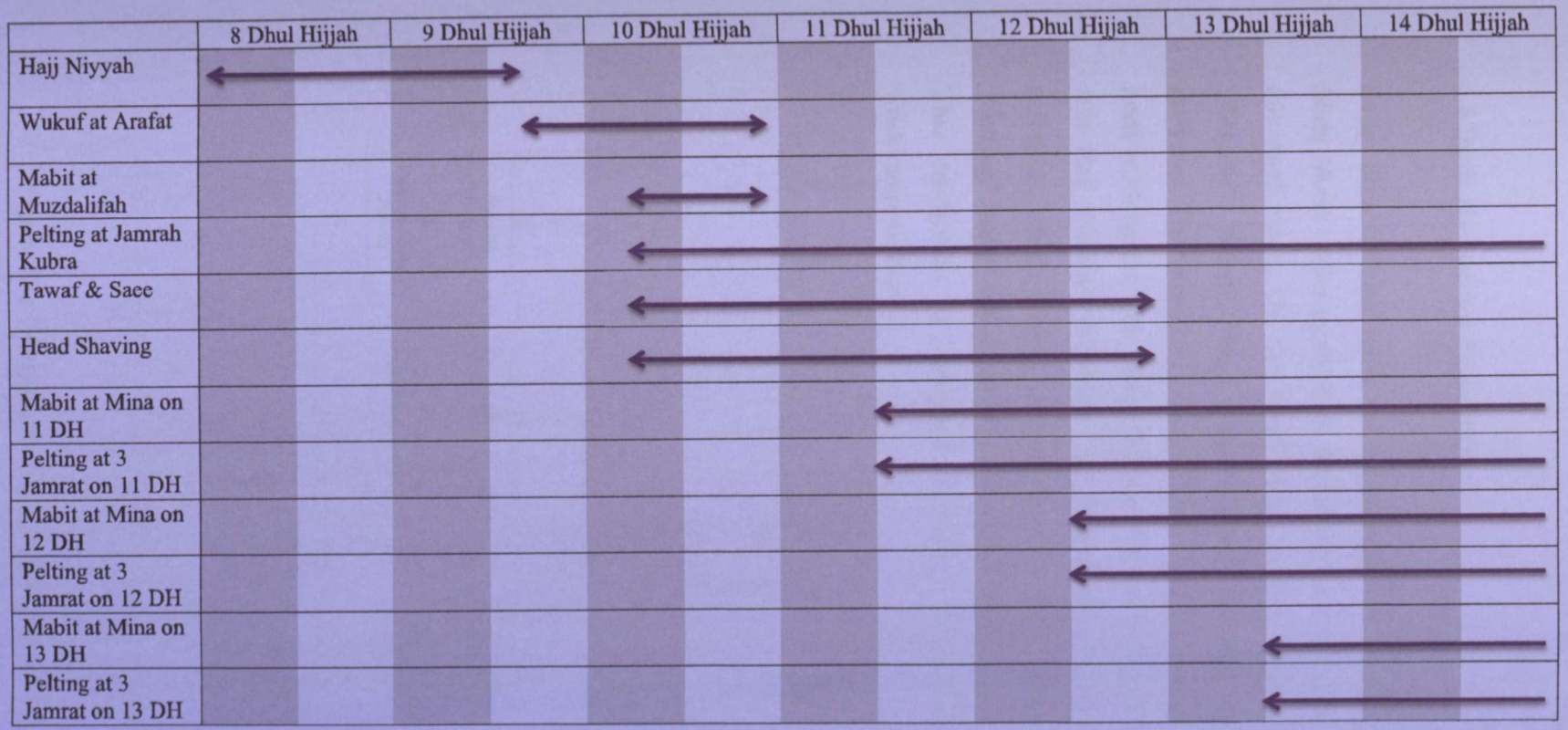


Figure 4.4: Flow Chart of Real-Time Hajj Mobile Guidance activities.



Symbol	Description
	Timeline from Maghrib until Fajr .
	Timeline from Fajr until Maghrib.
⟷	Must be perform during the specific time.
←	Can be perform starting on specific time until the end of Hajj month.

Figure 4.5: Timeline of Hajj Activities.

4.6 Basic Navigation Procedure

Every time the user starts this application, the first screen that will be seen is the Main Menu of the application. Refer Figure 4.6 for the navigation of activities for this application. On the Main Menu screen, there are four buttons, which are "Resume", "Start", "Hajj Progress" and "Setting" that link to several different activities. The "Resume" button will navigate the user to the last activity that the user been working on. The "Start" button will navigate the user to the activity that starts new Hajj checklist activities. The "Hajj Progress" button will link to the progress activities, which enable the user to view their current Hajj progress. Lastly, the "Setting" button link to an activity, which enable the user to reset the application. This navigation is designed to help the author in developing the real workingapplication.

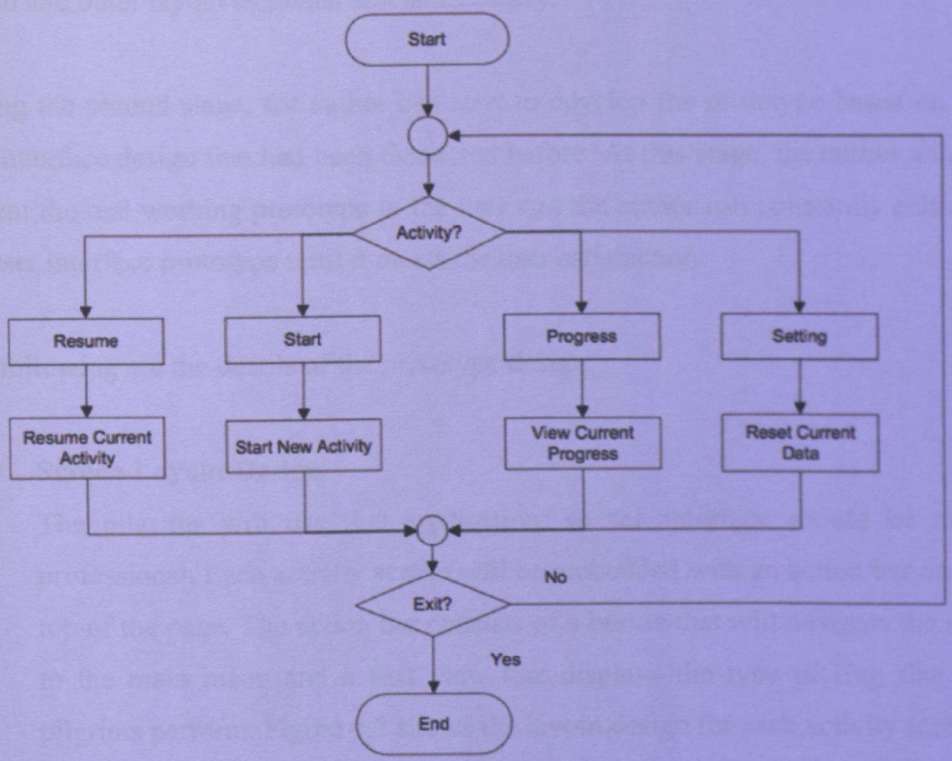


Figure 4.6: Navigation of Real-Time Hajj Mobile Guidance Activities

4.7 User Interface Prototype

The process of designing and developing the graphical user interfaces for this Real-Time Hajj Mobile Guidance involve lots of end-users. It is difficult for the author or the user to design and develop the suitable user interface abstractly because it is hard to explain exactly what the user want. By having a physical prototype, it is easier to identity the most suitable user interface prototype to be integrated with the application functionality.

The first stage of designing the prototype is by having the paper-based design user interface which is the most efficient method to start a prototype development. For each screen, the author included a description of the functionality carried by the particular screen and the layout design, which comprises of the text view, checkbox, button and other layout elements that is necessary.

During the second stage, the author can start to develop the prototype based on the user interface design that had been discussed before. At this stage, the author able to present the real working prototype to the user and the author can constantly enhance the user interface prototype until it meets the user satisfaction.

The following are the details of the prototype design:

- **Screen Layout Design**

  The pilgrims will use this application, so the interface should be more professional. Each activity screen will be embedded with an action bar on the top of the page. The action bar consists of a button that will navigate the user to the main menu and a text view that displays the type of Hajj that the pilgrims perform. Figure 4.7 shows the layout design for each activity screen.

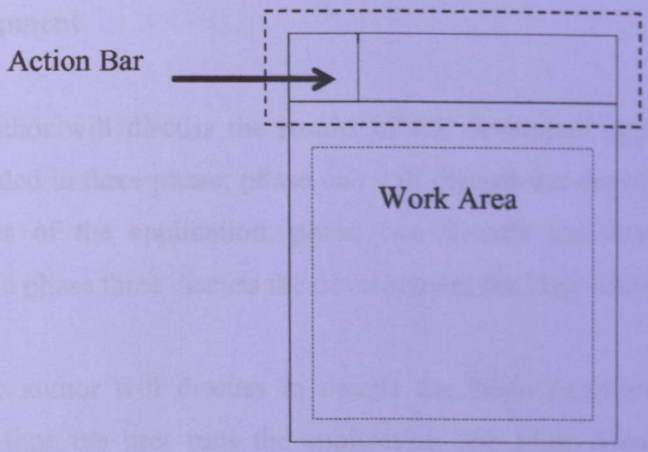


Figure 4.7: Screen Layout Design

- **Color**

  The application is design based on three colors, which are light blue, black and green. The author decides to use these colors because the combination of these colors can produce an application that is suitable for all range of ages.

- **Graphical Design**

  This application is not necessarily need lots of graphical design since the aim of this application is to assist the pilgrims during Hajj. The working area only consists of check box, text view and button to make the application simpler and easier to be used.

4.8 Project Development

In this part, the author will discuss the results of the developed application. This section will be divided in three phase; phase one will discuss the development of the basic functionalities of the application, phase two discuss the development for Umrah activities and phase three discuss the development for Hajj activities.

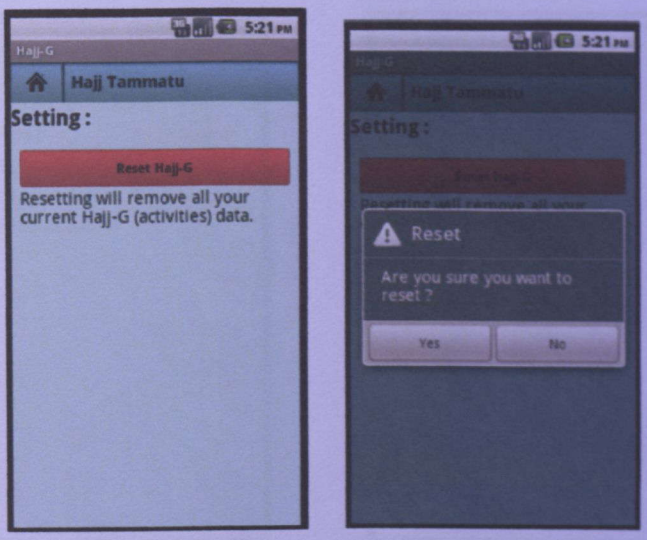
For phase one, the author will discuss in details the basic functionalities of the application. Every time the user runs the application, the Main Menu screen will appear. Figure 4.8(a) shows the Main Menu screen in English language and Figure 4.8(b) shows the Main Menu screen in Malay language.

(a) in English language (b) in Malay language

Figure 4.8: Main Menu screen

If there is no current activity in the database, the Resume button will be disabled. Or else, clicking the Resume button will navigate the user to the current activity the user is working with before the user return to the Main Menu. The Start button will navigate the user to the first activity screen, which is Umrah Niyyah. This activity, Umrah Niyyah, is the first activity that the pilgrims need to perform during Hajj.

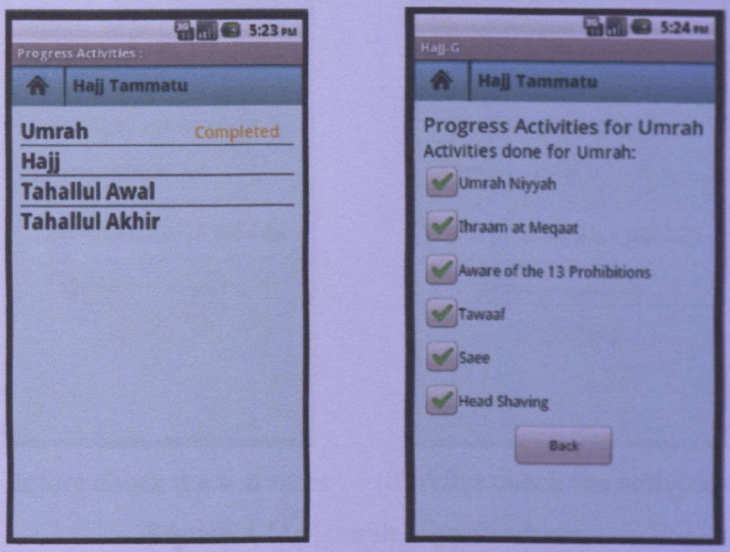
By clicking on the Setting button, the user will be navigated to the setting options as shown in Figure 4.9 (a). The application allows the user to reset the application, which removing all the activities that previously been stored in the database. An alert dialog as shown in Figure 4.9 (b) will pop up before the user can reset the application. This is to ensure the user do not accidentally reset the application.



(a) Setting Screen (b) Alert Dialog

Figure 4.9: Setting screen

The Hajj Progress enabled the user to check their current Hajj progress. It shows the status for each part of the Hajj Tammatu'; Umrah and Hajj. A text will appear if that particular part of Hajj activities completed, as shown in Figure 4.10(a). The user can check the status of the details for each part of Hajj Tammatu' by clicking on the item list. Refer to Figure 4.10(b) for the details of activities' status.

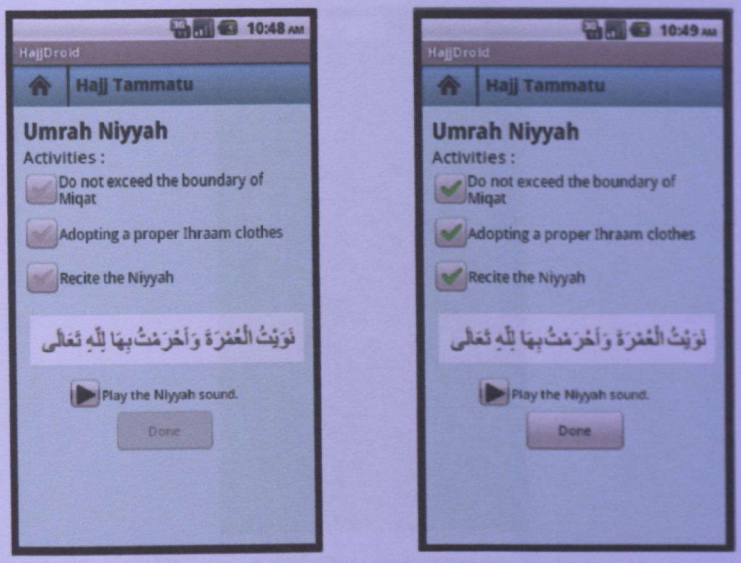


(a) Activities Status (b) Details of Activities

Figure 4.10: Hajj Progress screen

Besides showing the status for each part of Hajj activities, it also shows the status for each Hajj achievement; Tahallul Awal and Tahallul Thani. A text will appear if the user had achieved these Hajj achievements.

During phase two, the author develop the activities for Umrah which is the first part of Hajj Tammatu'. Whenever the user clicks on Start button, the user will be navigated to Umrah Niyyah screen. Umrah Niyyah is the first activity for Umrah.



(a) Before check the activities (b) After check the activities

Figure 4.11: Umrah Niyyah screen

The Umrah Niyyah screen wills displays all the activities that the user need to perform. The application also enables the user to play the Niyyah audio and refer to the image of Umrah Niyyah statement for niyyah recitation.

The Done button will only be able to click by the user if the use had checked all the checkbox as shown in Figure 4.11(b). The Done button will be disabled in the user unchecked one of the checkbox as shown in Figure 4.11(a).

The application will also notify the user if the user already in the state of Ihraam. Refer Figure 4.12 for the notification dialog. This notification is important because while performing Hajj, the user need to be aware of the prohibitions during Ihraam.

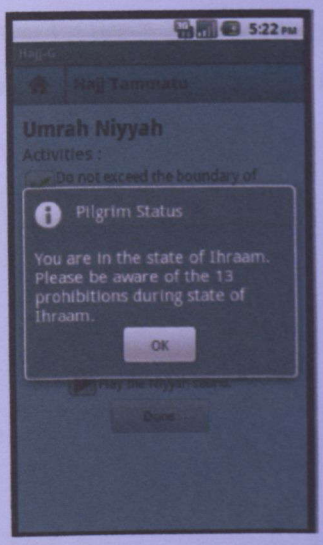


Figure 4.12: State of Ihraam dialog

Once the user click on the Done button at Umrah Niyyah screen, the user will be navigated to the next activity according to the sequences which are Prohibitions during Ihram, followed by Tawaaf. The user needs to obey to all the Tawaaf rules in order to get a valid Tawaaf. Refer Figure 4.13 for Tawaaf Checkpoint screen. If the user violated any of the rules, the user needs to re-perform the Tawaaf. Or else, the user can proceed with Saee and Head Shaving. The rules checking also applied to Saee.

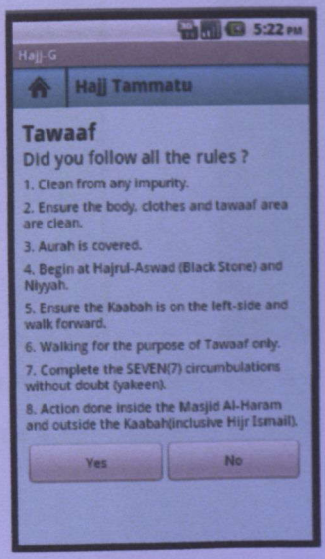


Figure 4.13: Tawaaf Checkpoint screen

Before the user can completely perform his Umrah, he must pay his dumm, if any. According to the checklist of Umrah dumm checked by the user as shown in Figure 4.14, this application able to automatically classify and display the list of *dumm* that the user need to pay as shown in Figure 4.15(a). The application displays the details payment for each type of *dumm* whenever the user click on the item list as shown in Figure 4.15(b).

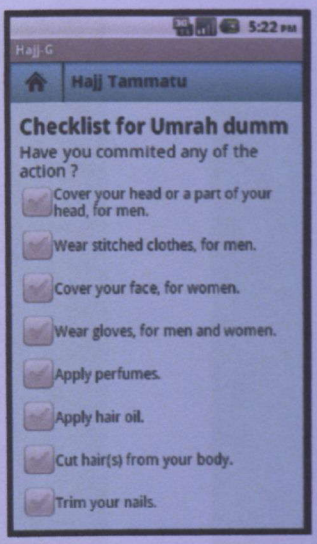
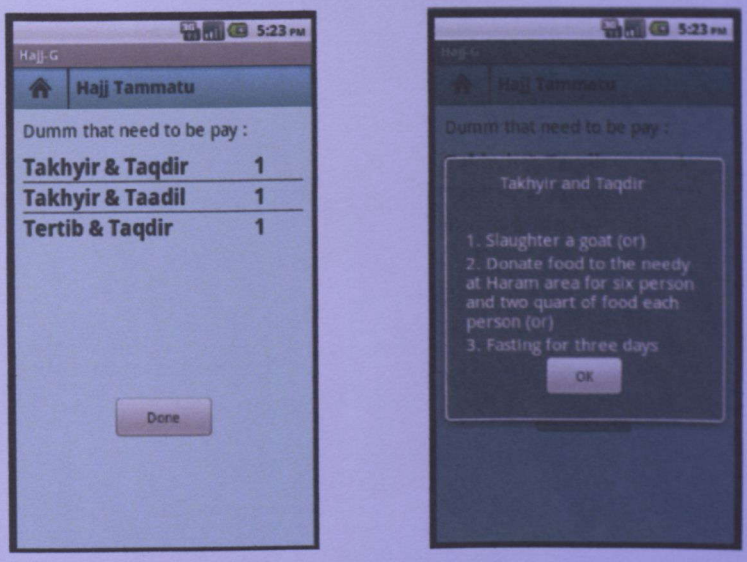


Figure 4.14: Checklist for Umrah dumm



(a) List of *Dumm* (b) Details of payment for each *dumm*

Figure 4.15: Dumm need to be paid

After the user has done with the *dumm* payment, a dialog box will pop up notifying the user of their pilgrimage status. If the current date is not reach the valid date to perform Hajj, a dialog box will inform the user to wait until the valid date for performing Hajj to proceed with the second part of Hajj Tammatu'. Or else, a dialog box will inform the user that the user can proceed with Hajj Niyyah. Refer Figure 4.16 for the pilgrimage status.

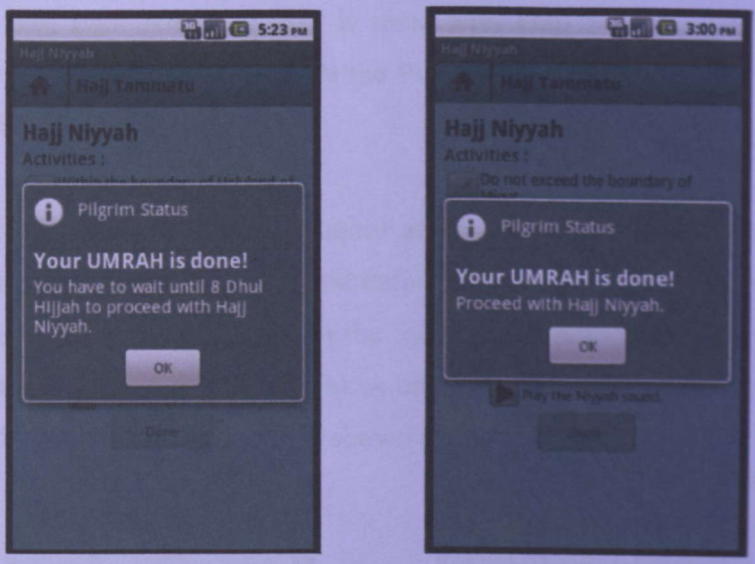
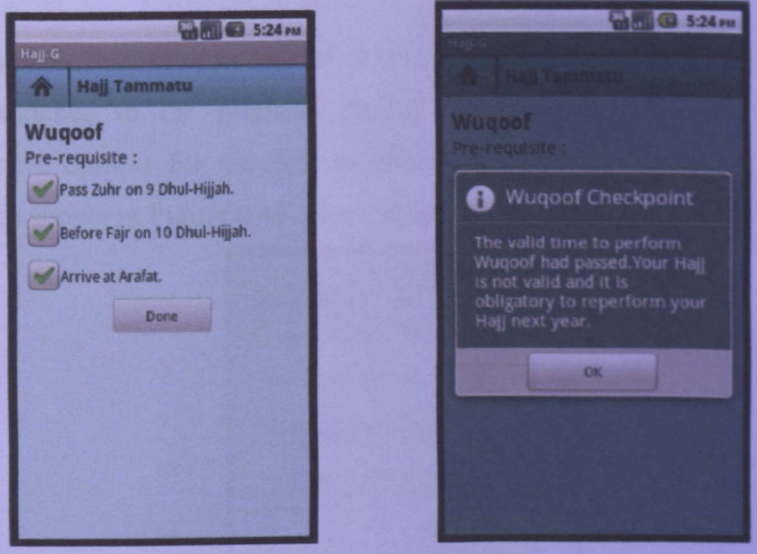


Figure 4.16: Pilgrim Status (Umrah)

Phase three will discuss in details about the development of the second part of the Hajj Tammatu' which is Hajj activities. The author develops this phase based on the sequences of Hajj activities shown in Section 4.5.

When the user is done with Umrah part, the user will be navigated to the Hajj Niyyah screen, which enable the user to start performing Hajj. Hajj Niyyah is the first activity for Hajj part. After the user is done with Hajj Niyyah, the user will be navigated to the next activity, which is the Prohibitions during Ihraam, followed by Wuqoof at Arafat.

There are some activities such as Wuqoof at Arafat and *Mabit* at Muzdalifah that needs certain requirement to be fulfilled before the activities can be performed. The application needs the user to check on the requirement before the user can perform the activities as shown in Figure 4.17(a). A dialog box will be pop-up displaying the result from the pre-requisition input as shown in Figure 4.17(b), if any.



(a) Wuqoof Pre-requisite (b) Result dialog box

Figure 4.17: Wuqoof Checkpoint.

If the user meets all the pre-requisition, the user will be navigated to the Wuqoof at Arafat activity. The same procedure will be applied to *Mabit* at Muzdalifah activity, which the user must meets all the pre-requisites at first before the user can continue with this activity.

Besides that, the application will also displays the recommendation activities as shown in Figure 4.18. These recommendation activities are activities that the user can perform besides than the main activity on that particular time.

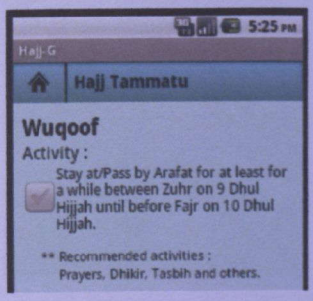


Figure 4.18: Recommendation of activities.

Based on the functionalities discussed in Section 4.4, this application provides the real-time guidance to the pilgrims during the Hajj journey. This application immediate give options for the user to choose the next act to perform based on destination as shown in Figure 4.19 after the user is done with Mabit at Muzdalifah.

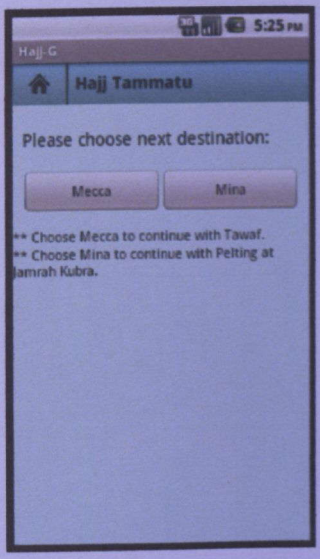


Figure 4.19: Choices of destination.

If the user decides to change the destination later on, a confirmation dialog will pop up as shown in Figure 4.20 to notify the user about the changes. The confirmation dialog also reminds the user of the current destination.

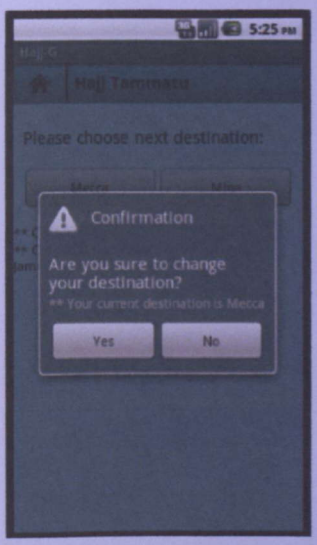


Figure 4.20: Changing the destination

After the user had chosen the preferred destination, the application will assist the user for the subsequent Hajj activities according to the flow chart sequences for the preferred path until the user completed all the Hajj activities. For Tawaaf, Saee and Head Shaving, these activities applied the same procedure as in the Umrah part. The same choosing destination (activities) procedure will be applied every times the user have the options to choose the destination.

There are some activities that can only be done after a specific date such as *Mabit* at Mina and Pelting at the Three Jamrat. An alert dialog will be shown if the user has not reach the valid time to perform these activities. Refer Figure 4.21 for the alert dialog for Mina checkpoint.

Figure 4.21: Mina Checkpoint

Besides that, a dialog notification will appear if the user had achieved any of the Hajj achievements; Tahallul Awal and Tahallul Thani. The dialog notifications also shows the details for each type of Hajj achievements as shown in Figure 4.22(a) and Figure 4.22(b).

(a) Tahallul Awal Dialog

(b) Tahallul Thani Dialog

Figure 4.22: Hajj Achievement Dialog

After the complete performing all the Hajj activities, the user will be give options to choose either Nafar Awal or Nafar Thani. Refer to Figure 4.23 for the screen shot of the choosing Nafar options. Choosing Nafar Awal means the user only needs to pay the Hajj dumm, if any, to complete his Hajj. On the other hands, choosing Nafar Thani means the user needs to perform pelting at the Three Jamrat one more time, stay at Mina for another one night and pay the Hajj dumm if the user committed any of the prohibitions.

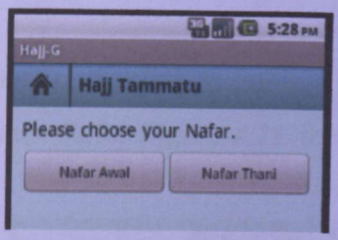


Figure 4.23: Choosing Nafar

If the user decided to change the Nafar, a confirmation dialog will pop up to notify the user about the changes as shown in Figure 4.24. This dialog also remind the user regarding the current Nafar the user had chosen before.

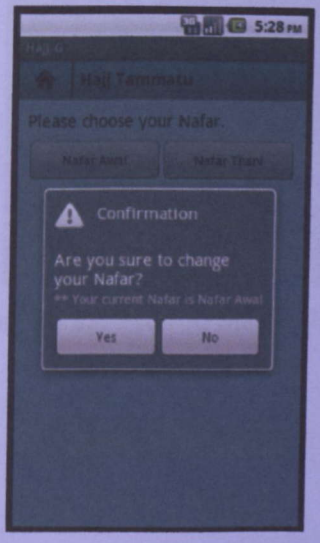


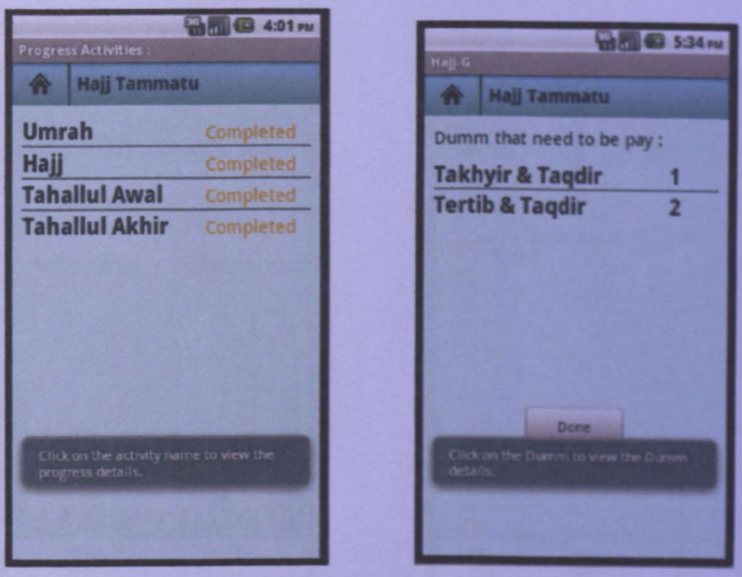
Figure 4.24: Changing Nafar Dialog

After completed all the Hajj activities, the user need to pay the Hajj dumm, if any. The paying Hajj dumm procedure is the same with paying Umrah dumm. The user only need to check on the prohibitions been committed and the application will automatically display the dumm that the user need to pay. However, for Hajj activities, the dumm check will be done twice to ease the user. The first time is after the user achieves Tahallul Awal, and the second time is after the user had completed all the Hajj activities.

After done with the paying dumm, if any, a dialog box will appear notifying the user regarding the pilgrimage status. Refer Figure 4.25 for the pilgrimage status dialog box.

Figure 4.25: Pilgrim Status (Hajj)

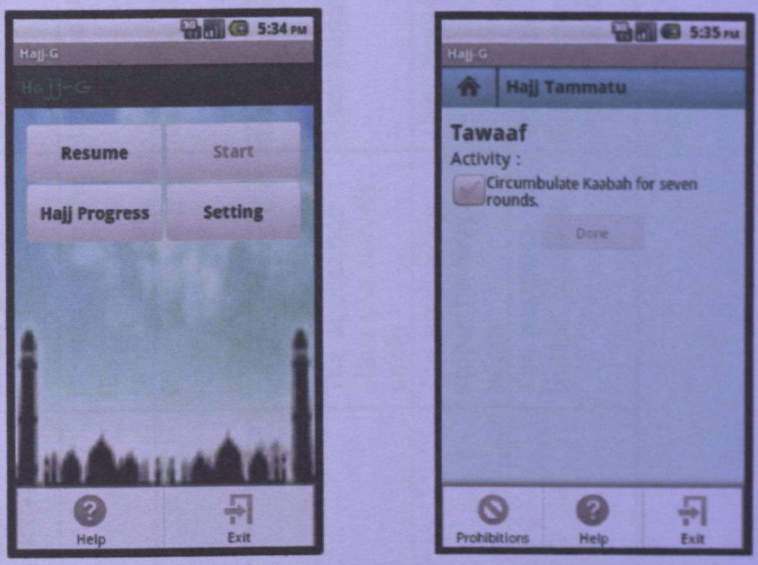
As a user-friendly application, this application display toast message containing friendly instruction purposely to guide the user on how to use the application. However, this toast message will be displayed on certain screen activity only. Refer Figure 4.26 for the toast message.



(a) Progress Activity (b) Dumm List Activity

Figure 4.26: Toast Message

Besides that, the author also include menu bar consist of Help button and Exit button for main menu and one additional button which is Prohibitions for each activity screen. Help button will inform user on how to user the application. Exit button will exit the application and Prohibitions button displays the thirteen (13) Prohibitions during Ihraam.



(a) Main Menu (b) Activity

Figure 4.27: Menu Bar

4.9 Real-Time Hajj Mobile Guidance Integration Test Plan

SI No	Test case name	Test Procedure	Pre-condition	Expected Result	Reference to Detailed Design/Spec Document	Results
1	User_Resume_Button	Click on "Resume" button	Has to have current activity	Direct user to current activity	User Module	Pass
2	User_Start_Button	Click on "Start" button	None	Direct user to the first activity, Umrah Niyyah	User Module	Pass
3	User_Progress_Button	Click on "Progress" button	None	Direct user to the Hajj Progress activity	User Module	Pass
4	User_Setting_Button	Click on "Setting" button	None	Direct user to the Setting activity	User Module	Pass
5	User_Play_Button	Click on "Play" button	None	The application plays the Niyyah audio	User Module	Pass
6	User_Stop_Button	Click on "Stop" button	None	The application stops the Niyyah audio	User Module	Pass
7	ResumeButton	Check whether the Resume will be disabled if there is no current activity	No current activity in the database	The Resume Button disabled	Software Requirement Specification	Pass

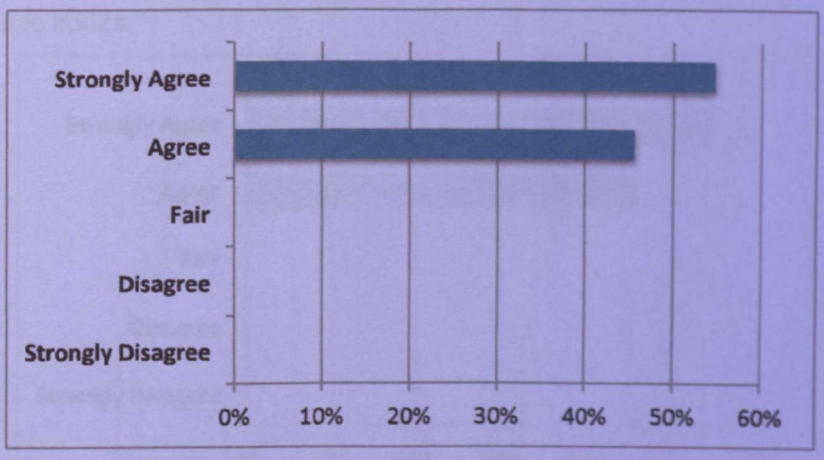
8	User_Done_Button	Click "Done" button	User need to check all the required activity	Direct user to the next activity	User Module	Pass
9	DoneButton	Check whether the Done will be enabled if all the check box been checked	User need to check all the check box of required activity	The Done button enabled	Software Requirement Specification	Pass
10	User_Home_Button	Click "Home" button	None	Direct user to the MainMenu screen	User Module	Pass
11	User_Dumm_ListItem	Click Dumm List Item	Need to have Dumm	Display dialog box with the details of dumm payment	User Module	Pass
12	User_Progress_ListItem	Click Progress List Item	None	Direct user to the details progress of the activity	User Module	Pass
13	User_Reset_Button	Click "Reset" button	None	Clear all the data in the database.	User Module	Pass
14	StartButton	Check whether the Start will be disabled if there iscurrent activity	Current activity in the database	The Start button will be disabled	Software Requirement Specification	Pass

4.10 Post-Implementation Survey

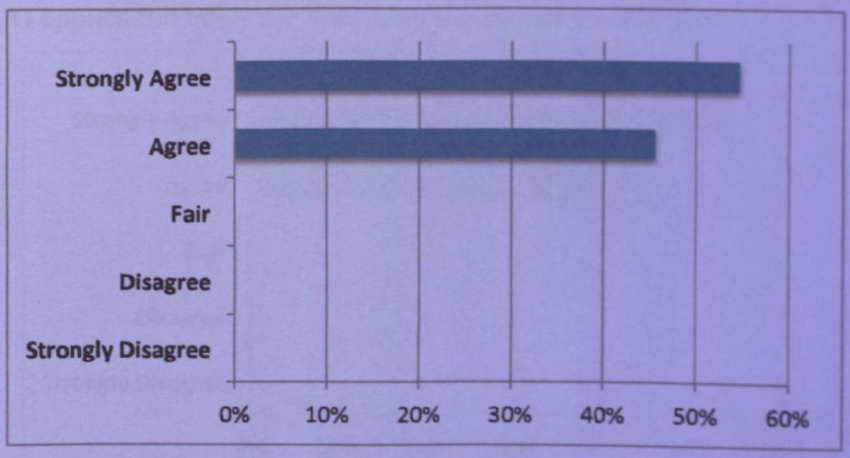
The author had conducted a survey for the Real-Time Hajj Mobile Guidance (Hajj-G) prototype in order to evaluate the effectiveness of the prototype. This survey consist of ten (10) rating questions to evaluate the user-friendliness, informatively and usability of the prototype and one (1) open-answer question for improvement of the prototype. Refer Appendix 3 for the survey form. It had been done to a group of target respondent aged 15 years old to 54 years old.

Below are the result gathered from the survey:

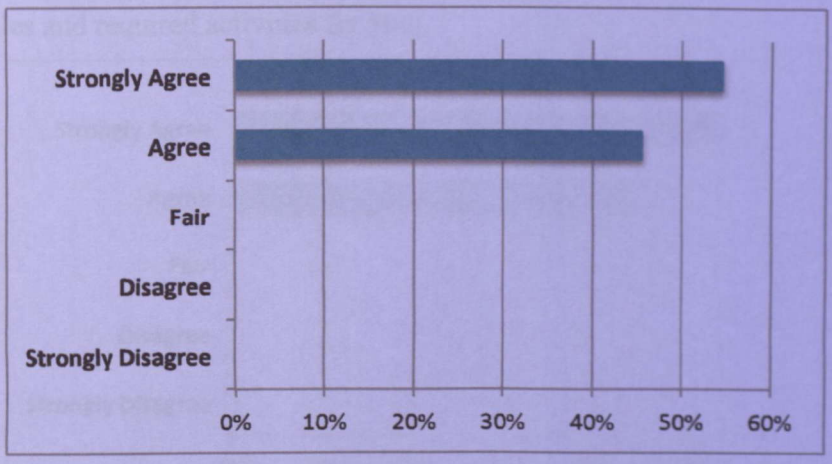
I. The graphical user interface of the application is user-friendly.



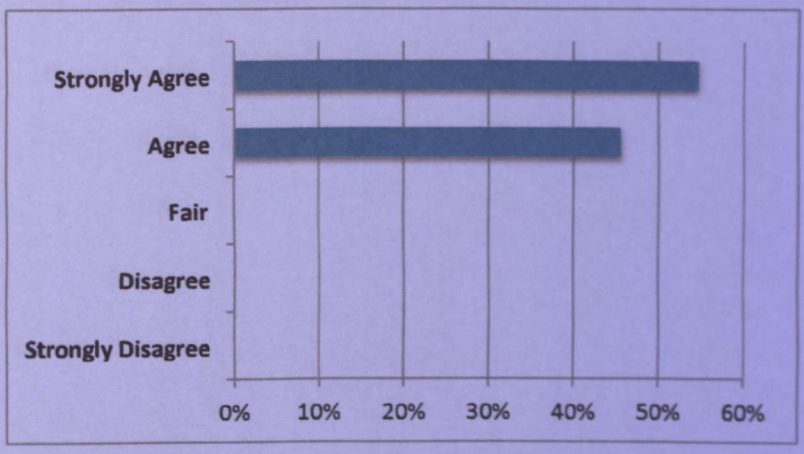
II. It is easy and simple to navigate through the Hajj-G application.



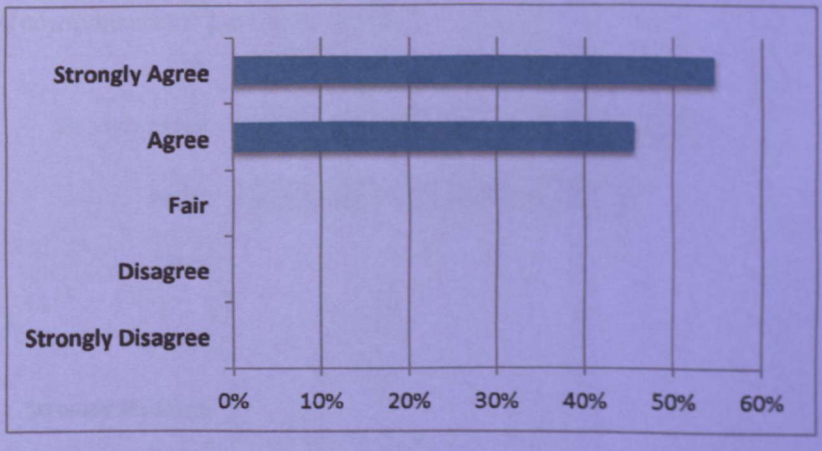
III. Hajj-G will help the "Last-Minute" pilgrims to perform Hajj easily.



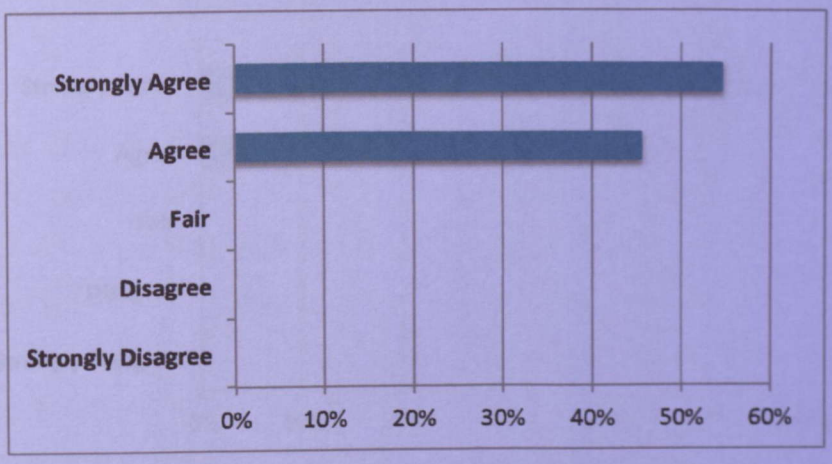
IV. I found out the Hajj-G application to be more interactive compared to Hajj guidance books.



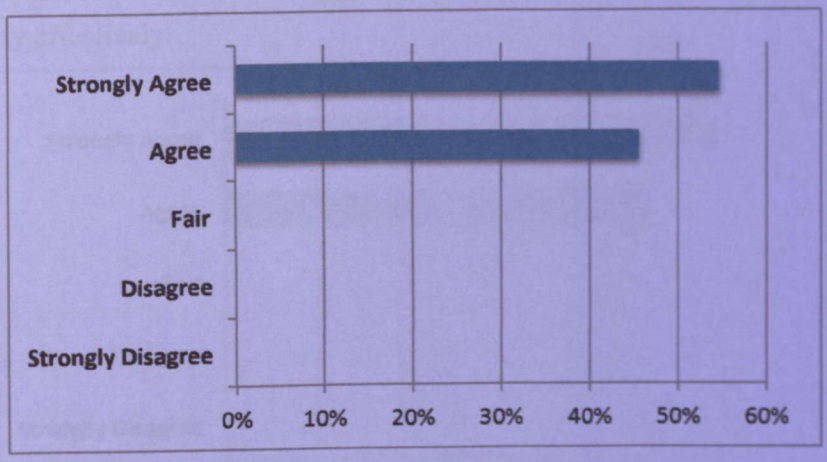
V. Hajj-G application helps me remember the Ihraam prohibitions.



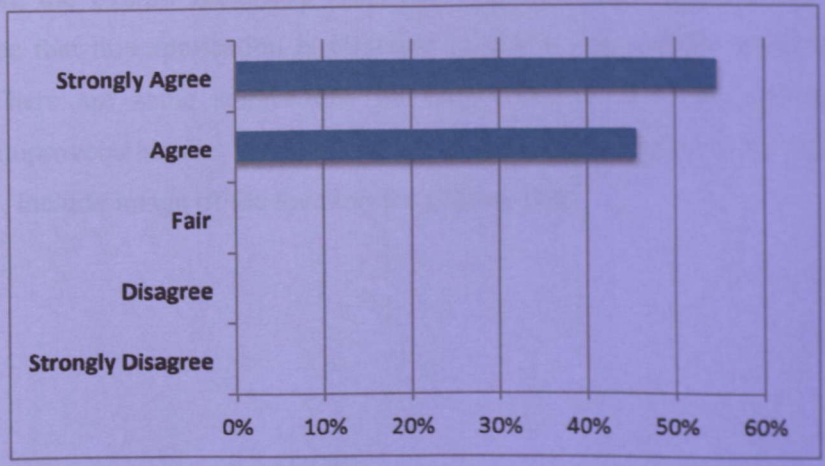
VI. By using Hajj-G application, I do not have to worry if I cannot remember all the rules and required activities for Hajj.



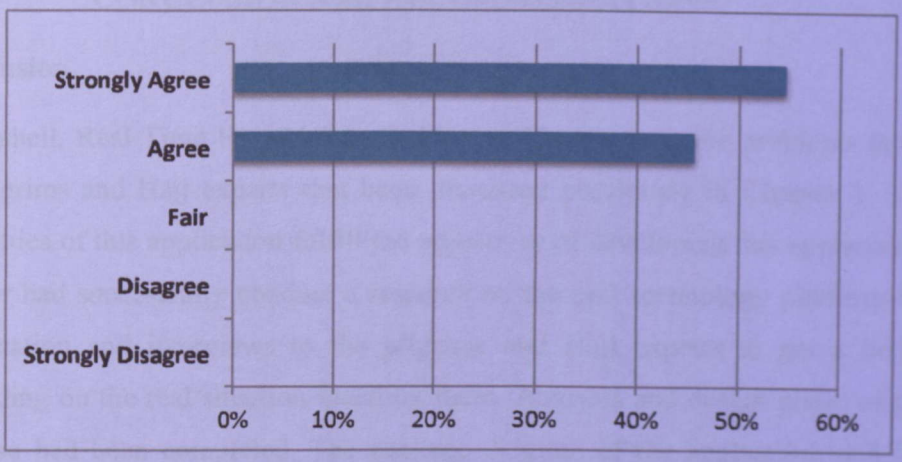
VII. All the information in the application are simple and easy to understand.



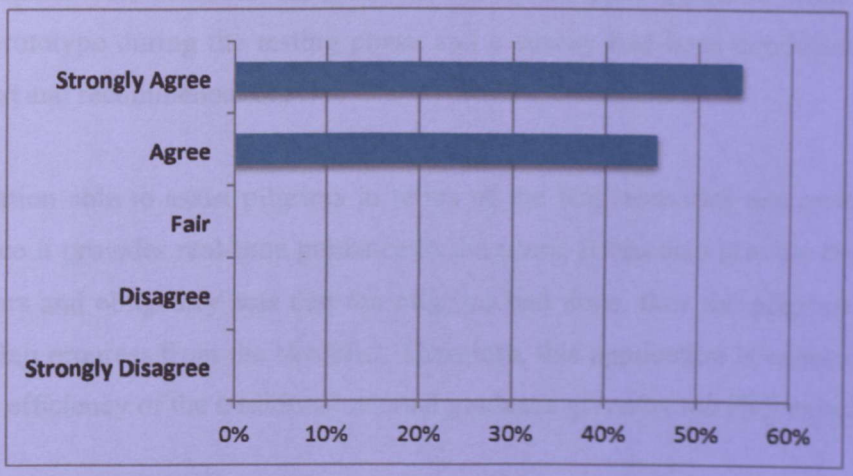
VIII. The dumm (compensation) checklist enables the user to categories the dumm(compensation) payment easily.



IX. The Niyyah audio provided in the application helps me recite the Niyyah easily.



X. The Hajj Progress helps me keep track of the progress of the each Hajj activity effectively.



In conclusion, the overall feedbacks from the respondents are positive and they strongly agree that this application is effective in giving Hajj mobile guidance for pilgrims. There are some suggestions for improvement from the respondents. Among the improvements are; include alarm reminder, video demos with audio for each activity, include image of the location for each activity.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

In the nutshell, Real-Time Hajj Mobile Guidance able to overcome problems faced by the pilgrims and Hajj experts that been discussed previously in Chapter 1. The functionalities of this application fulfill the objectives of developing this application. The author had successfully conduct a research on the best technology platform for this application and interviews to the pilgrims and Hajj experts to get a better understanding on the real situation faced by them. Analysis and design phase of the system also had been completed. The package diagram of the application and the flow chart of the Hajj activities had been design to get the clear picture of how the application works. This application undergoes few cycles of prototyping cycle phase before the author able to come out with the final prototype. Qualified tester had tested the prototype during the testing phase and a survey had been conducted for improvement and recommendation.

This application able to assist pilgrims in terms of the Hajj activities that needs to perform since it provides real-time guidance to the users. It can also provide the list of Hajj pillars and obligatory acts that the pilgrims had done, thus the pilgrims can view their Hajj progress from the checklist. Therefore, this application is expected to increase the efficiency of the traditional manual guidance given by the Hajj experts.

5.2 Recommendations and Future Work

The first recommendation for this application is to add more information for each Hajj activities in the application. This application is still in Version 1.0 which the application only comprises important information for each Hajj activities. By having extra information for each Hajj activities in future, the pilgrims whom not really prepare for Hajj can use this application as their preparation in performing Hajj.

In addition, Real-Time Hajj Mobile Guidance should have video demos and audio for each of the Hajj activities. The purpose of having the video demos is to provide a better understanding for the pilgrims on how to perform the activity. It will be more convenient to use this video demos instead of getting the guidance from the Hajj experts or other pilgrims. The audio will be added to guide the pilgrims on how to correctly perform the prayer during each Hajj activities. This alternative will be more effective rather than the Hajj experts need to guide each pilgrim during the Hajj journey.

For time being, the Real-Time Hajj Mobile Guidance is only designed for Hajj Tammatu', which is only one from the three types of Hajj due to the time constraints. Currently, only pilgrims whom performing Hajj Tammatu' can use the application. The author plans to implement the Hajj activities for the other two types of Hajj; Hajj Ifrad and Hajj Qiran in the developed application. Thus, make the application compatible for all type of Hajj. This will widen the range of pilgrims whom can use this application.

Real-Time Hajj Mobile Guidance is a mobile application for Android platform, which means only smart phones, which embedded with Android OS can use this application. This application can be further enhanced to make it compatible with iOS and Symbian OS since these two mobile OS also have the high market share in the world. However, the decision of making this system compatible with the other mobile OS will be based on the market demand on the application.

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Appendix 2: Gantt Chart (Part 2)

NO	Details/Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Research Work														
1	Gathering data														
2	Update Abstract														
3	Update Introduction														
4	Update Literature Review														
5	Update Methodology														
6	Update Result & Discussion														
7	Update Conclusion														
	Technical Work														
8	Design the GUI														
9	Hardcode the System														
10	Prepare Draft for Progress Report														
11	**Submission of Progress Report**							X							
12	*Project Development Continues*														
13	Prepare for Pre-EDX														
14	**Pre-EDX**										X				
15	Prepare Final Draft of Dissertation														
16	**Submission of Dissertation**											X			
17	Prepare for Viva (Oral Presentation)														
18	**Viva (Oral Presentation)**													X	
19	Prepare Final Draft for Technical Report														
20	**Submission of Technical Report**														X

Appendix 1: Gantt Chart (Part 1)

NO	Details/Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	**Selection of Project Topic**														
	Preliminary Research Work														
2	Gathering data														
3	Designing workflow														
4	Designing UI for the system														
5	Write abstract of study														
6	Identify Problem Statement														
7	Write literature review														
8	Methodology														
9	**Submission of Extended Proposal Defense**						X								
10	**Preparation for Proposal Defense**														
11	**Proposal Defense**									X					
12	**Project work continues**														
13	**Prepare Draft Interim Report**														
14	**Submission of Interim Draft Report**										X				
15	**Prepare Final Draft Interim Report**														
16	**Submission of Interim Report**											X			
17	**Prepare Technical Report**														
18	**Submission of Technical Report**													X	

Appendix 3: Post-Implementation Survey

Real-Time Hajj Mobile Guidance (Hajj-G) Prototype Testing

The purpose of this survey is to evaluate the effectiveness of the Real-Time Hajj Mobile Guidance (Hajj-G) application in guiding pilgrims performing Hajj.

Please state your gender.

- ○ Male
- ○ Female

Please state your age.

15 - 24	25 - 34	35 - 44	45 - 54	Above 55
○	○	○	○	○

The graphical user interface of the application is user-friendly.

Strongly Disagree	Disagree	Fair	Agree	Strongly Agree
○	○	○	○	○

It is easy and simple to navigate through the Hajj-G application.

Strongly Disagree	Disagree	Fair	Agree	Strongly Agree
○	○	○	○	○

Hajj-G will help the "Last-Minute" pilgrims to perform Hajj easily.

Strongly Disagree	Disagree	Fair	Agree	Strongly Agree
○	○	○	○	○

I found out the Hajj-G application to be more interactive compared to Hajj guidance books.

Strongly Disagree	Disagree	Fair	Agree	Strongly Agree
○	○	○	○	○

Hajj-G application helps me remember the Ihraam prohibitions.

Strongly Disagree	Disagree	Fair	Agree	Strongly Agree
○	○	○	○	○

By using Hajj-G application, I do not have to worry if I cannot remember all the rules and required activities for Hajj.

Strongly Disagree	Disagree	Fair	Agree	Strongly Agree
○	○	○	○	○

All the information in this application are simple and easy to understand.

Strongly Disagree	Disagree	Fair	Agree	Strongly Agree
○	○	○	○	○

The dumm(compensation) checklist enables the user to categorize the dumm(compensation) payment easily.

Strongly Disagree	Disagree	Fair	Agree	Strongly Agree
○	○	○	○	○

The Niyyah audio provided in the application helps me recite the Niyyah easily.

Strongly Disagree	Disagree	Fair	Agree	Strongly Agree
○	○	○	○	○

The Hajj Progress helps me keep track of the progress of each Hajj activity effectively.

Strongly Disagree	Disagree	Fair	Agree	Strongly Agree
○	○	○	○	○

Please give your suggestions for improvement :